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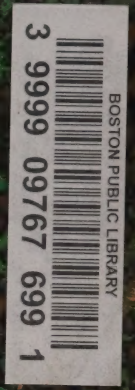

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THE

# NATURE-PRINTED

# BRITISH SEA-WEEDS.

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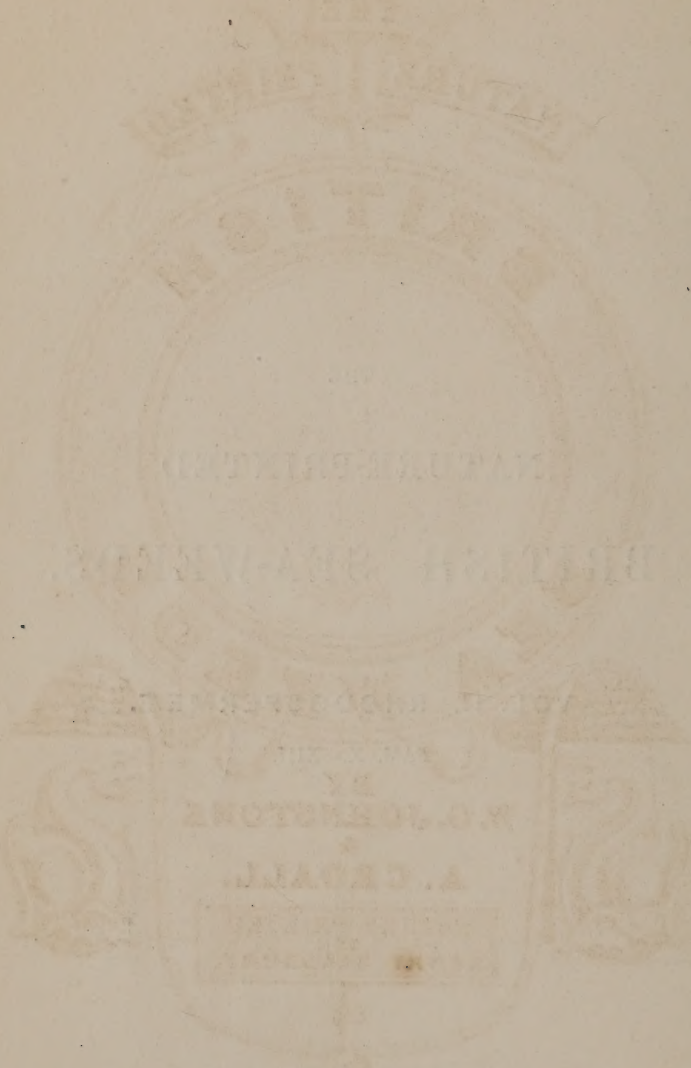
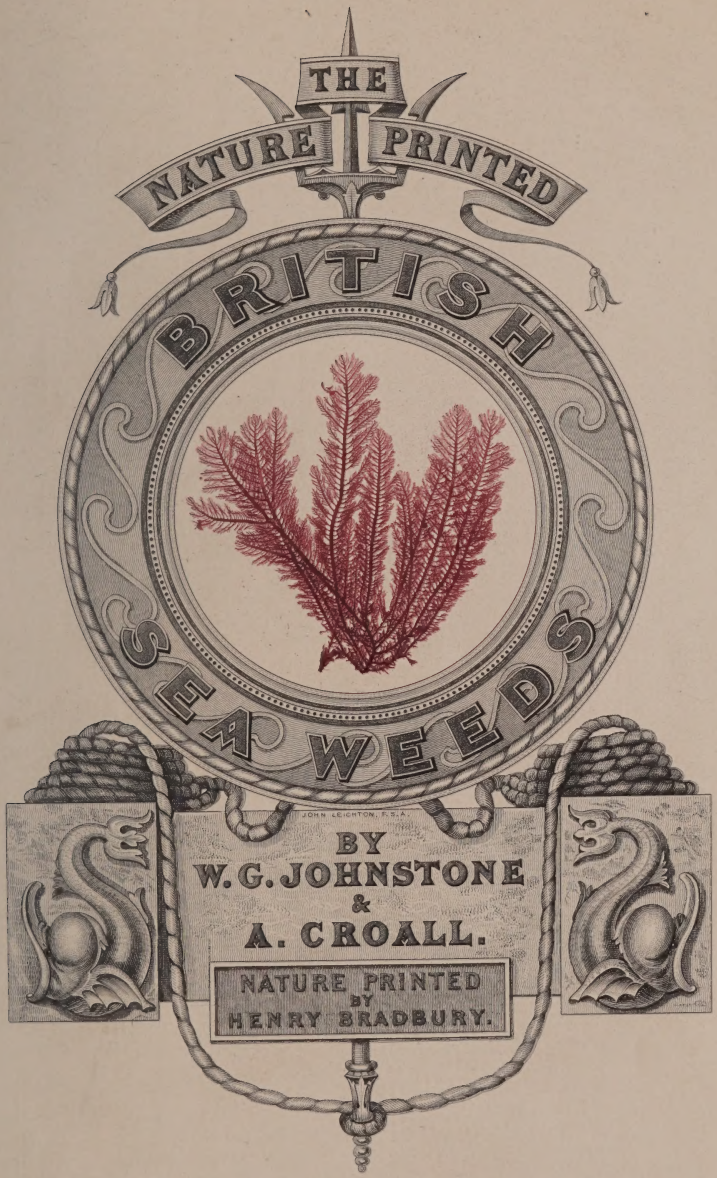
## VOL. II. RHODOSPERMEÆ.

FAM. X.—XIII.






LONDON.
BRADBURY & EVANS, 11, BOUVERIE St
1859.

THE

# NATURE-PRINTED

# BRITISH SEA-WEEDS:

## A HISTORY,

ACCOMPANIED BY FIGURES AND DISSECTIONS, OF THE ALGÆ OF THE BRITISH ISLES.

BY

WILLIAM GROSART JOHNSTONE, F.B.S.E.,

AND

ALEXANDER CROALL, A.B.S.E.

NATURE-PRINTED BY HENRY BRADBURY.

IN FOUR VOLUMES.

VOL. II.—RHODOSPERMEÆ.

FAM. X.—XIII.

LONDON:
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ROBERT KAYE GREVILLE, ESQ., LL.D.,

EDINBURGH,

AS A MEMENTO OF MANY PLEASING ASSOCIATIONS,

IN ACKNOWLEDGMENT OF FAVOURS RECEIVED,

AND AS RENDERING HOMAGE TO WHOM IT IS PECULIARLY DUE,

This Second Volume of

THE NATURE-PRINTED BRITISH SEA-WEEDS

IS,

WITH EVERY SENTIMENT OF RESPECT AND ESTEEM,

DEDICATED BY

THE AUTHORS.

# ALPHABETICAL INDEX OF SPECIES.

## VOLUME II.

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# Plate LXVII.

## WORMSKIOLDIA SANGUINEA.—*Spreng.*

Gen. Char.—Frond membranaceous, flat, with percurrent midrib and lateral veins. Fructification of two kinds, on distinct plants: 1. Coccidia, spherical, and shortly stalked, produced on defoliated midribs of old plants; 2. Tetraspores, imbedded in small leaf-like processes, similarly produced.

Wormskioldia *sanguinea*.—Stem short, cylindrical, branched, beset with large, oblong or obovate leaf-like fronds with entire waved margins, and a strong percurrent midrib, closely pectinated on each side by opposite lateral veins; tubercles produced on the midribs of old battered fronds; tetraspores immersed in small leaf-like expansions, also on old midribs.

Wormskioldia *sanguinea*.—*Spreng. Syst. Veg.* vol. iv. p. 331; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 408.

Delesseria *sanguinea*.—*Lamour. Ess.* p. 124; *Lyngb. Hyd. Dan.* p. 7, t. 2; *Ag. Sp. Alg.* vol. i. p. 172; *Ag. Syst.* p. 248; *Hook. Fl. Scot.* part 2, p. 100; *Grev. Fl. Edin.* p. 292; *Grev. Alg. Brit.* p. 72; *Hook. Br. Fl.* vol. ii. p. 285; *Wyatt, Alg. Danm.* No. 13; *Endl.* 3rd Suppl. p. 53; *Kütz. Phyc. Gen.* p. 445, t. 67; *Harv.* in *Mack. Fl. Hib.* part 3, p. 191; *Harv. P. B.* plate 151; *Harv. Man.* p. 114; *Harv. Syn.* p. 95; *Atlas*, plate 37, fig. 169.

Fucus *sanguineus*.—*Linn. Syst. Nat.* vol. ii. p. 718; *Lightf. Fl. Scot.* vol. ii. p. 942; *Huds. Fl. Angl.* p. 573; *Stack. Ner. Brit.* t. 7; *Turn. Syn.* vol. i. p. 7; *Turn. Hist.* t. 36; *E. Bot.* t. 1041.

Hab.—In shady rock-pools, between tide-marks. Biennial. Fruit in winter. Common all round the British coasts.

Geogr. Dist.—Atlantic shores of Europe; Baltic Sea.

Description.—Root a hard conical disc, with a broad flattened base. Frond with a short, cylindrical, biennial, once or twice divided stem, from which arise on all sides sessile or slightly stalked, at first lanceolate, afterwards oblong, obovate or roundish, obtuse or acute, entire fronds generally more or less waved at the margin, often much so when old, with a strong percurrent midrib, pectinated on each side with close-set opposite veins, simple, and running somewhat obliquely to the margin. In young fronds the outline is more or less lanceolate, tapering to the base, and more shortly to the summit, which is rounder but often more or less acute at the apex; gradually they become more oblong, and ultimately

elongate, obovate, and obtuse, becoming still broader in age until the outline is almost round, and the tapering summit, and even the base, is entirely lost. In young specimens the margin is entirely or almost flat—in old specimens excessively full and waved, as if the outer part of the frond had entirely outgrown the midrib, which is often proliferous in old plants. Fructification produced in winter and spring on the old naked midribs. Tubercles spherical, stalked, unilateral, containing a dense mass of ovate spores. Tetraspores triparted, immersed in small leaf-like processes (sporophylla); both kinds of fruit are common. Structure entirely composed of minute roundish, coloured cells, except the central portion of the midrib, where they are large, ovate, and colourless. Substance rather cartilaginous, when old not adhering very tenaciously to paper. Colour, a fine crimson pink, darker in age.

This fine species, both on account of the brilliancy of its colouring and the elegance of its form, is one of the most attractive and generally admired of our native marine flora. In size it is the largest of the genus, often reaching to the length of ten or twelve inches, but average specimens are not more than from four to six inches. Nor is it less common than beautiful, being found in almost every deep, shady rock-pool on all our shores, larger and finer in deep, sheltered spots, where it is less liable to be torn by the storm, which its thin delicate fronds are but ill suited to resist, so that it is often no easy matter to find a large specimen free from laceration. In the month of May they may be found about half grown, quite entire, and the colours fresh and beautiful; but as the summer advances they become more or less torn, and in autumn and winter are often cast on the beach in large bunches, consisting of several dozens of fronds, and are then a tempting bait to the young algologist who may see the plant for the first time; but no sooner has he commenced to analyse his prize than he finds every leaf split across to the midrib into innumerable narrow laciniæ, consisting of one, two, or three veins, margined with a narrow membrane, the only remains of the frond.

We have seen the frond occasionally divided at the summit, each portion being furnished with its correspondent division of the midrib, and Professor Harvey mentions a still more curious and extraordinary variety, having the "frond divided in a manner between palmate and pinnate into several deep undulated lobes, whose apices are again lobed."

These forms, however, are purely accidental, and may be often caused by some accidental injury done to the frond during the earlier stages of its growth.

It delights in deep shady pools, and generally under the shelter or shade of some overhanging crag, as it is very impatient of the direct

rays of the sun. On pushing aside the fringe of *Laminariæ* that form a deep curtain round such situations, this species may often be observed deep in the recess with several of its equally coy associates, effectually screened both from the keen eye of day as well as the no less prying eye of the algologist.

In examining the spores of this species, we have frequently found the whole of those in a capsule readily separate under the microscope into six segments—to be in fact *tetraspores*, while in other capsules not one of them would separate.

## EXPLANATION OF PLATE LXVII.

Fig. 1.—*Wormskioldia sanguinea*, natural size.
2.—Portion of old midrib, with sporophylla.
3.—A sporophyllum.
4.—Tetraspores.
5.—Portion of midrib with tubercles.
6.—A tubercle.
7.—Spores. All magnified.

*Wormskioldia? Sanguinea. Sprengel.*

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# Plate LXVIII.

## PLOCAMIUM COCCINEUM.—*Lyngb.*

Gen. Char.—Frond linear, solid, cellular, compressed or flat, much and distichously branched; ultimate ramuli pectinato-secund in series on the upper edge of the branches. Fructification of two kinds, on distinct plants: 1. Spherical tubercles or coccidia, containing a mass of minute angular spores; 2. Pods or stichidia, frequently much branched, containing imbedded, roundish oblong, transversely parted tetraspores. Name from πλόκαμος, "plaited hair."

Plocamium *coccineum.*—Frond cartilaginous, linear, much branched distichously; branches irregularly alternate or secund, ultimate ramuli in fours, pectinato-secund on the upper edges of the branches. Tubercles lateral, sessile, spherical; stichidia marginal, often two to three times dichotomous.

Plocamium *coccineum.*—*Lyngb. Hyd. Dan.* p. 39, t. 9; *Grev. Alg. Brit.* p. 98, t. 12; *Hook. Br. Fl.* vol. ii. p. 293; *Wyatt, Alg. Danm.* No. 20; *Ag. Alg. Medit.* p. 155; *Endl.* 3rd Suppl. p. 52; *Kütz. Phyc. Gen.* p. 449, t. 64; *Mont. Pl. Cel. Canar.* p. 152; *Hook. fil. Fl. Antarct.* vol. i. p. 186; *Harv.* in *Mack. Fl. Hib.* part 3, p. 195; *Harv. Phyc. Brit.* plate 44; *Harv. Man.* p. 119; *Harv. Syn.* p. 102; *Atlas*, plate 39, fig. 178; *Harv. N. B. A.* part 2, p. 153; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 395.

Plocamium *vulgare.*—*Lamour. Ess.* p. 50; *Gail. Dict. Sc. Nat.* vol. liii. p. 368.

Plocamium *Lyngbyanum.*—*Kütz.* l. c. p. 450.

Plocamium *Binderianum.*—*Kütz.* l. c. p. 450.

Delesseria *coccinea.*—*Ag. Syn.* p. 14; *Hook. Fl. Scot.* part 2, p. 101; *Grev. Fl. Edin.* p. 294.

Delesseria *Plocamium.*—*Ag. Sp. Alg.* vol. i. p. 180; *Syst.* p. 250; *Mart. Fl. Brazil.* p. 42.

Ceramium *Plocamium.*—*Roth, Fl. Germ.* vol. iii. p. 458; *Cat. Bot.* vol. ii. p. 161, and vol. iii. p. 107.

Fucus *coccineus.*—*Huds. Fl. Angl.* p. 586; *Linn. Trans.* vol. iii. p. 187; *Stack. Ner. Brit.* p. 106; *Turn. Syn.* vol. ii. p. 291; *Hist.* t. 59; *E. Bot.* t. 1242.

Fucus *Plocamium.*—*Gm. Hist.* p. 153, t. 16, fig. 1; *Lightf. Fl. Scot.* vol. ii. p. 957; *Esper, Ic.* vol. i. p. 18, t. 2.

Var. β. *uncinata.*—Very small; branches somewhat flexuous, more irregular and entangled; ultimate ramuli patent or even recurved.

Plocamium *coccineum*, β *uncinata.*—*Harv. Phyc. Brit.* plate 44, fig. 9.

Plocamium *coccineum*, δ *uncinatum.*—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 396.

Hab.—On rocks and Algæ. Everywhere common. Perennial. Summer and autumn.

Geogr. Dist.—Plentiful in the temperate zones. Brazil (*Martius*); Cape Horn (*Dr. Hooker*); Auckland Island; New Zealand; Tasmania; Cape of Good Hope (*Dr. Harvey*).

Description.—Root of numerous branching fibres. Fronds tufted, four to eight inches long or more, about half a line in breadth, linear, more or less compressed, and somewhat two-edged, much branched distichously; branches irregularly alternate, sometimes secund, patent or erecto-patent, ultimate ramuli in series of three or mostly four, pectinato-secund on the upper edges of the branches, short and subulate, curved upwards. Structure cellular, solid; central cells large, roundish oblong, smaller towards the surface, where they are minute and coloured. Substance cartilaginous, imperfectly adhering to paper. Colour, a bright transparent crimson, not changing when dry, passing into pale orange, and ultimately into a dirty white in decay. Tubercles spherical, sessile, often abundant, lateral on the branches. Stichidia also common, similarly situated, at first simple, oblong, often at length two to three times dichotomously divided; the apices entire, emarginate or forked, with two to four transverse rows of roundish oblong, transversely zoned tetraspores, imbedded in their upper part.

This beautiful though common plant, a great favourite with collectors, is the only British representative of a genus which finds its greatest development in the southern hemisphere, and which is formed of plants as remarkable for the beauty of their form as the brilliancy of their colouring, and all agreeing in the peculiar arrangement of the ultimate ramuli, a peculiarity which adds much to their beauty.

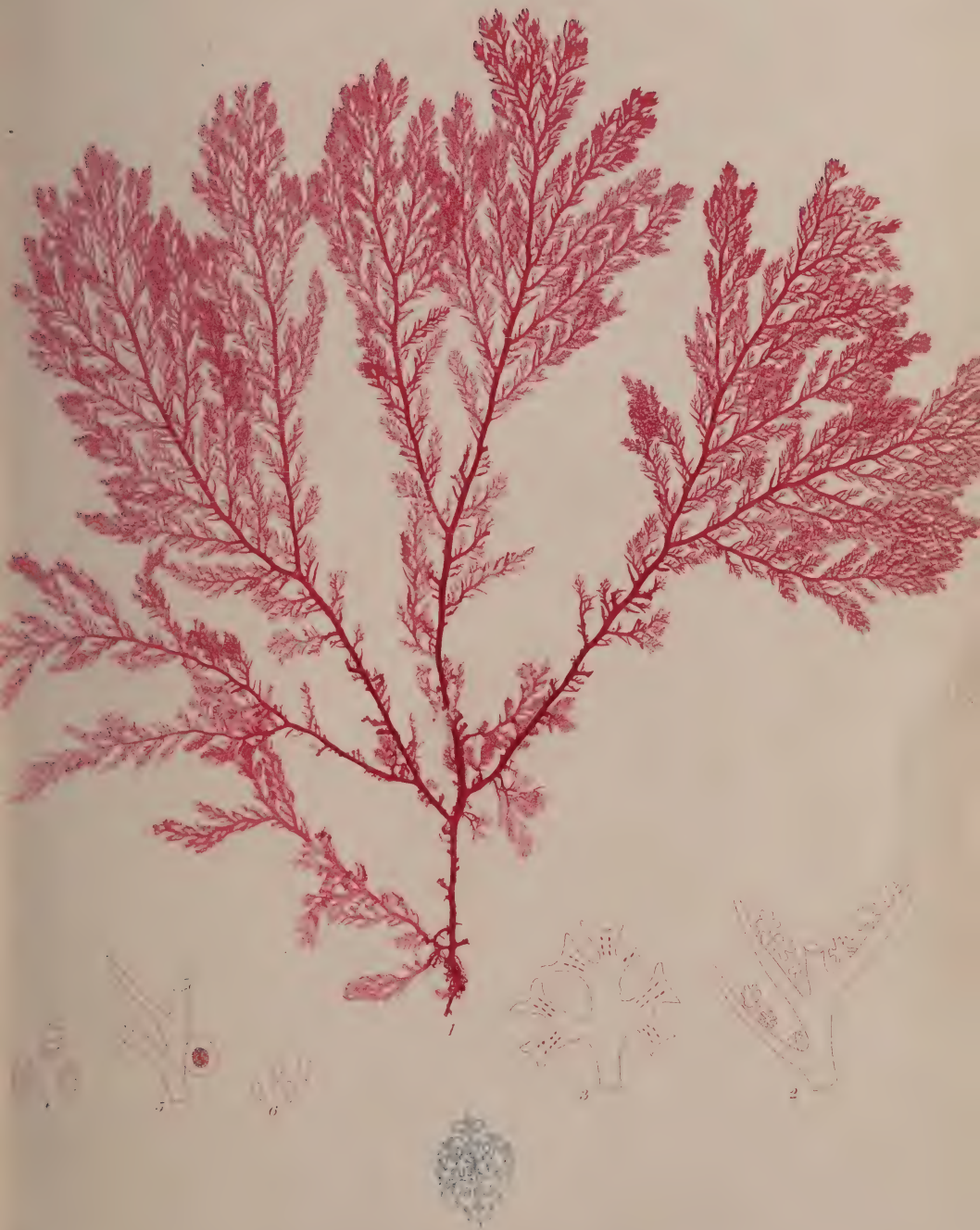
The present species is widely distributed, and is one of the commonest weeds on all our shores, occasionally found in deep tide-pools near low-water mark, but generally in deeper water, and only found in profusion among rejectamenta after heavy gales. Both kinds of fruit are abundant, and the species is very constant to its characters, differing only in size and the degree of ramification. In these particulars, however, there is great variation, specimens being at times met with which would not find ample room on a quarto page, while in others the size has dwindled down to such pigmy dimensions, that the aid of the microscope is necessary to show the identity of the species. Even in the larger varieties so great dissimilarity is found in the habit from the great difference in the number and length of the branches, that one finds some difficulty in being convinced that more than one species is not included under the name.

The variety β *uncinata* is the most remarkable, and were it not that so many intervening forms occur, and that the recurvation of the branchlets is by no means constant, we would feel strongly tempted to distinguish this as a species. Its place of growth is also remarkable, growing as it does on rocks almost level with the sand, which partially covers them, about half-tide level. In such places we have found it

abundantly, but always barren, often scarcely exceeding half an inch in size, but as much branched almost as specimens measuring a foot in diameter.

## EXPLANATION OF PLATE LXVIII.

Fig. 1.—*Plocamium coccineum,* natural size.
2.—Branch with stichidia.
3.—Stichidium from same.
4.—Tetraspores from same.
5.—Branch with tubercle.
6.—Spores from same. All magnified.



*Plocamium coccineum. Lyngb.*

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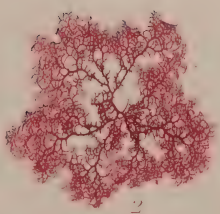


1. PLOCAMIUM coccineum LYNGB.
2. " " VAR. β. UNCINATA HARV.



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# Plate LXIX.

## RHODYMENIA PALMETTA.—*Grev.*

Gen. Char.—Fronds flat, subcoriaceous, cellular, without veins or midrib. Fructification of two kinds, on distinct plants: 1. Convex tubercles (coccidia), containing a mass of minute spores attached by a central placenta; 2. Tetraspores, cruciate, imbedded in cloud-like patches among the surface cells of the frond. Name from ῥοδεος, "red," and ὑμὴν, "a leaf or membrane."

Rhodymenia *Palmetta*.—Frond with a short cylindrical stem, flat, four to six times dichotomously divided in fan-shaped manner; segments with rounded axils, obcuneate, upper divisions linear oblong, with rounded apices; tubercles almost spherical, sessile; tetraspores imbedded in the apices of the segment, forming dark red sori.

Rhodymenia *Palmetta*.—*Grev. Alg. Brit.* p. 88, t. 12; *Hook. Br. Fl.* vol. ii. p. 290; *Wyatt, Alg. Danm.* No. 109; *J. Ag. Alg. Medit.* p. 153; *Endl.* 3rd Suppl. p. 51; *Mont. Alger.* p. 68; *Harv.* in *Mack. Fl. Hib.* part 3, p. 194; *Harv. P. B.* plate 134; *Harv. Man.* p. 125; *Harv. Syn.* p. 104; *Atlas*, plate 39, fig. 180; *Harv. N. B. A.* part 2, p. 149; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 378.

Sphærococcus *Palmetta*.—*Ag. Sp. Alg.* vol. i. p. 245; *Ag. Syst.* p. 215; *Lyngb. Hyd. Dan.* p. 11; *Spreng. Syst. Veg.* vol. iv. p. 335; *Kütz. Phyc. Gen.* p. 410.

Delesseria *Palmetta*.—*Lamour. Ess.* p. 37.

Halymenia *Palmetta*.—*Gaill. Dict. Sc. Nat.* vol. liii. p. 361.

Fucus *Palmetta*.—*Esper, Ic. Fuc.* p. 84, t. 40 (excl. syn.); *Stack. Ner. Brit.* p. 102, t. 16; *Turn. Syn.* vol. i. p. 21; *Turn. Hist. Fuc.* t. 73; *E. Bot.* t. 1120.

Fucus *bifidus*.—*Huds. Fl. Angl.* p. 581.

β *Niccæensis*.—Frond simple, sometimes once forked, very narrow, rising from fibres.

*J. Ag.* l. c. p. 153; *Harv. P. B.* plate 134, fig. 3; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 379.

Hab.—On rocks, shells, and stems of *Laminaria digitata* at low-water and a greater depth. Annual. Summer and autumn. Common on the British shores, but most so on the west coast. β at Sidmouth (*Mrs. Griffiths, Miss Cutler*).

Geogr. Dist.—Atlantic shores of Europe; Mediterranean Sea.

Description.—Root, a broad flattened disc. Fronds densely tufted, two to five inches in length, with a short cylindrical stem a quarter of

an inch in length, and suddenly expanding into a broad flabelliform frond with a roundish outline, obcuneate at the base, four to six times dichotomously divided, all the divisions linear oblong, but by their forking, their outline is obcuneate; the ultimate segments linear, with rounded apices, pale and expanded when in fruit, afterwards more or less erose when the fruit has dropped off. Structure densely cellular; central cells rather small, gradually diminishing in size towards the surface, where they are excessively minute and closely packed, rendering the frond somewhat firm and coriaceous. Colour, a fine permanent brownish pink. Tubercles scattered on the segment, very convex, sessile; the pericarp thick, formed of the frond, and similar in structure, with a narrow pellucid limbus, and containing a dense mass of angular spores. Tetraspores forming dark coloured sori at the apices of the segments, cruciate, sometimes imperfectly so, and only tripartite.

This genus is now confined to those species having cruciate tetraspores. These, moreover, generally distinguished among their former congeners by thicker and more leathery fronds, and a darker and more sombre colour.

This pretty species is said to be "not uncommon on the British shores, from Orkney to Cornwall and Jersey;" but we have never met with it on the east coast.

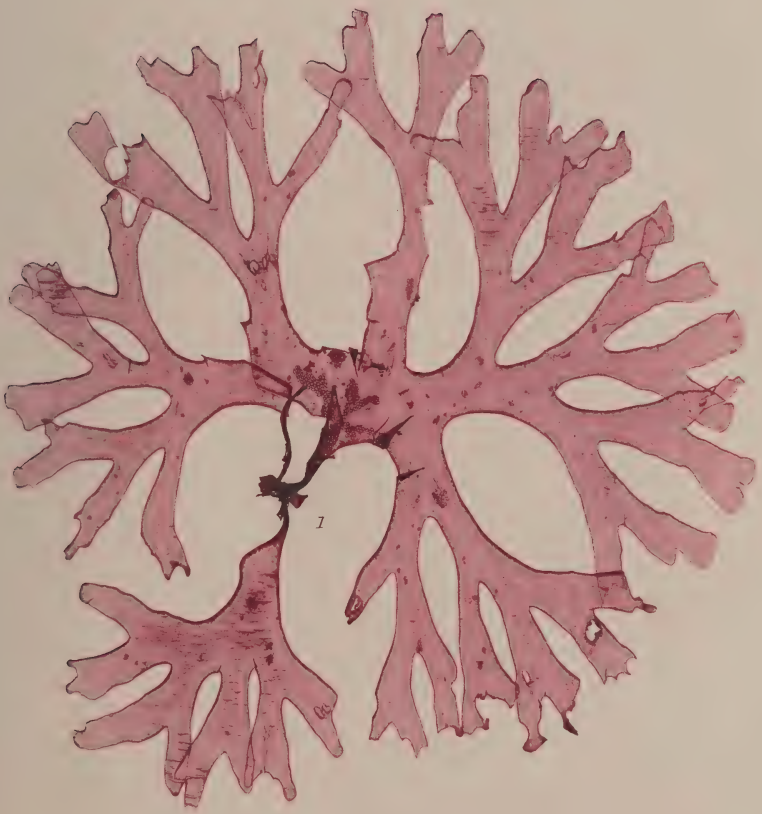
It is readily distinguished from the following by its smaller size, oblong segments, fan-like fronds, brighter colour and thinner substance.

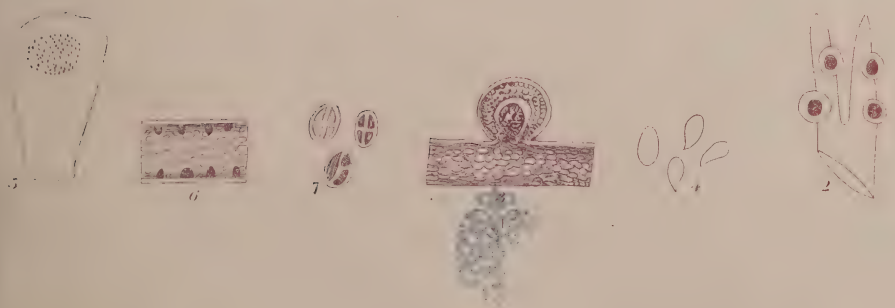
To *Phyllophora membranifolia* and *Brodiæi* it has also at times a close resemblance; from the first it may readily be distinguished by the narrow linear segments and brighter colour, but from the latter it is often no easy matter to separate it, especially when without fruit, almost the only difference being the somewhat more cuneate form and almost always more or less proliferous habit of *P. Brodiæi.*

The fruit affords a readier means of distinction, the tubercles being seldom wanting in *P. Brodiæi*, and they are almost invariably terminal: the proliferous elongations arising from among them, often in repeated series. Generally the segments of this are much broader but not always so, many specimens being as narrow as in *R. Palmetta*, but they are rarely so deeply or so much divided.

EXPLANATION OF PLATE LXIX.

Fig. 1.—*Rhodymenia Palmetta*, natural size.
2.—Segment with tubercles.
3.—Section of tubercle.
4.—Spores from same.
5.—Segment with tetraspores.
6.—Section of same.
7.—Tetraspores from same. All magnified.





*RHODYMENIA palmetta, GREV.*

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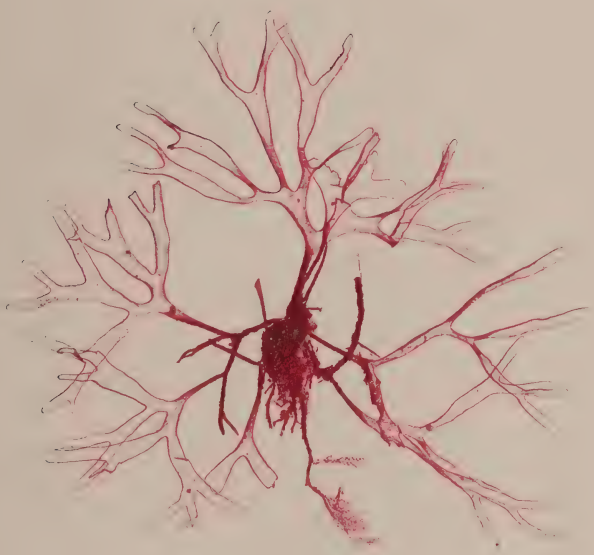


*Rhodymenia palmetta*,
*var. β. Nicæensis*.

# Plate LXX.

## RHODYMENIA PALMATA.—*Grev.*

Gen. Char.—Fronds flat, subcoriaceous, cellular, without veins or midrib. Fructification of two kinds, on distinct plants : 1. Convex tubercles (coccidia), containing a mass of minute spores attached by a central placenta ; 2. Tetraspores, cruciate, imbedded in cloud-like patches among the surface cells of the frond. Name from *ῥοδεος*, "red," and *ὑμὴν*, "a leaf or membrane."

Rhodymenia *palmata*.—Fronds tufted, somewhat leathery, irregularly dichotomous ; segments obtuse, frequently fringed more or less with proliferous laciniæ ; tetraspores in roundish sori scattered over the whole frond.

Rhodymenia *palmata*.—*Grev. Alg. Brit.* p. 93 ; *Hook. Br. Fl.* vol. ii. p. 291 ; *Wyatt, Alg. Danm.* No. 110 ; *Harv.* in *Mack. Fl. Hib.* part 3, p. 195 ; *Harv. P. B.* plate 217 ; *Harv. Man.* p. 127 ; *Harv. Syn.* p. 107 ; *Atlas*, plate 41, figs. 189, 190 ; *Harv. N. B. A.* part 2, p. 148 ; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 376.

Sphærococcus *palmatus*.—*Kütz. Phyc. Gen.* p. 409, t. 63, f. 1.

Halymenia *palmata*.—*Ag. Syn.* p. 55 ; *Ag. Sp. Alg.* vol. i. p. 204 ; *Ag. Syst.* p. 242 ; *Spreng. Syst. Veg.* vol. iv. p. 333 ; *Hook. Fl. Scot.* part 2, p. 107 ; *Post. & Rupp.* p. 18.

Delesseria *palmata*.—*Lamour. Ess.* p. 37.

Ulva *palmata*.—*Dec. Fl. Fr.* vol. ii. p. 12 ; *With.* vol. iv. p. 123 ; *Lyngb. Hyd. Dan.* p. 24 ; *Grev. Fl. Edin.* p. 298.

Fucus *palmatus*.—*Linn. Sp. Pl.* p. 1630 ; *Huds. Fl. Angl.* p. 579 ; *Lightf. Fl. Scot.* p. 933, t. 27 ; *Good. & Woodw. Linn. Trans.* vol. iii. p. 163 ; *Gunn. Fl. Norv.* vol. ii. p. 69 ; *Turn. Syn.* p. 175 ; *Turn. Hist.* t. 115 ; *E. Bot.* t. 1306 ; *Hook.* in *Fl. Lond.* new series, with a figure.

Fucus *ovinus*.—*Gunn. Fl. Norv.* vol. i. p. 96 ; *Mohr, Hist. Isl.* p. 245.

Fucus *caprinus*.—*Fl. Dan.* t. 1128 ; *Esper, Ic.* p. 146, t. 74.

Fucus *bullatus*.—*Fl. Dan.* t. 770.

Fucus *rubens*.—*Esper, Ic.* t. 75.

Fucus *dulcis*.—*Gmel. Hist.* p. 189, t. 26 (fide *Turner*).

Hab.—In the sea on rocks, on old shells, and on the stems of *Laminariæ*. Common all round the British coasts. Biennial. Winter, spring, and early summer.

Geogr. Dist.—Atlantic shores of Europe ; Iceland.

Description.—Root, a short flattened disc. Fronds much tufted,

from a very short cylindrical stem less than half an inch in length, gradually widening into a flat obcuneate frond, four to twelve inches long, several times divided in a subdichotomous or somewhat palmate manner, the segments from half an inch to two inches in breadth, obtuse and rounded at the extremities. So variable however is this common plant both in the number and division of the segments, that it would be no easy matter to translate them into intelligible language. Young fronds are generally entire, obovate, or lanceolate; they then gradually become emarginate, bifid, and dichotomous or palmate. At one time we find them in the form of a quadrant, the two sides containing the right angle being almost straight, the other rounded and somewhat deeply crenate. Again we find them with a cuneate base, the fronds oblong, and the apex cut into two to four short lobes; at another time we find them cut almost to the base, into extremely narrow linear segments; in one variety described by Professor Harvey scarcely a line in breadth. Between these are found intermediate states almost innumerable and of every possible form and degree of branching. Structure: in this there is little variation, uniformly cellular; cells of the centre rather small, those forming the surface strata excessively minute and coloured, all roundish, angular. Colour, a pale or dark reddish brown, becoming rather darker in drying, and passing into green in decay. Substance more or less coriaceous when old, somewhat more soft and membranaceous when young, scarcely adhering to paper. Tetraspores from cloud-like spots in different parts of the frond.

One of the most common and widely-distributed of our British Algæ, being found in greater or less abundance on all the shores and bays of the Atlantic, from the Arctic to the Antarctic Ocean, but not perhaps in the Pacific.

We are not aware that it is eaten anywhere in Scotland at the present day as an article of food, although it is said to have been so at one period; and it is still much eaten as a relish by all the inhabitants that live near the coast. It is always, we believe, eaten in the raw state; but we remember seeing, when a boy, some people giving it a slight scorching or roasting by rolling it round a heated poker, after which it had a very peculiar flavour, which to most persons, as well as to us, was very disagreeable. By this process the red colour was changed to a green. Those specimens which are covered by parasites, such as *Callithamnion virgatulum* and *Ectocarpus siliculosus*, are generally most in request, and many persons consider it no disparagement that a few of the smaller crustacea (*Idotea*) and minute shell-fish (*Rissoa* and young *Mytilus*, &c.), form a part of the delicate morsel. When sold in the markets, or hawked through the towns or rural districts, as it often is

during the summer months, the young stems of *Laminaria digitata* (Tang or Tangle) are generally mixed up with it, and also a sprinkling of pepper dulse (*Laurencia pinnatifida*).

In estuaries where the water is brackish, it often grows to a large size, and is then of a paler colour, the fronds are often quite entire, or but slightly divided at the summit, and the structure is somewhat more lax. Such specimens are generally of an oval or oblong form, and are often from twelve to eighteen inches in length.

EXPLANATION OF PLATE LXX.

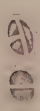
Fig. 1.—*Rhodymenia palmata*, natural size.
2.—Portion of a frond with part of a sorus.
3.—Tetraspores.
4.—Portion of surface with tubercles. All magnified.

1

2

3

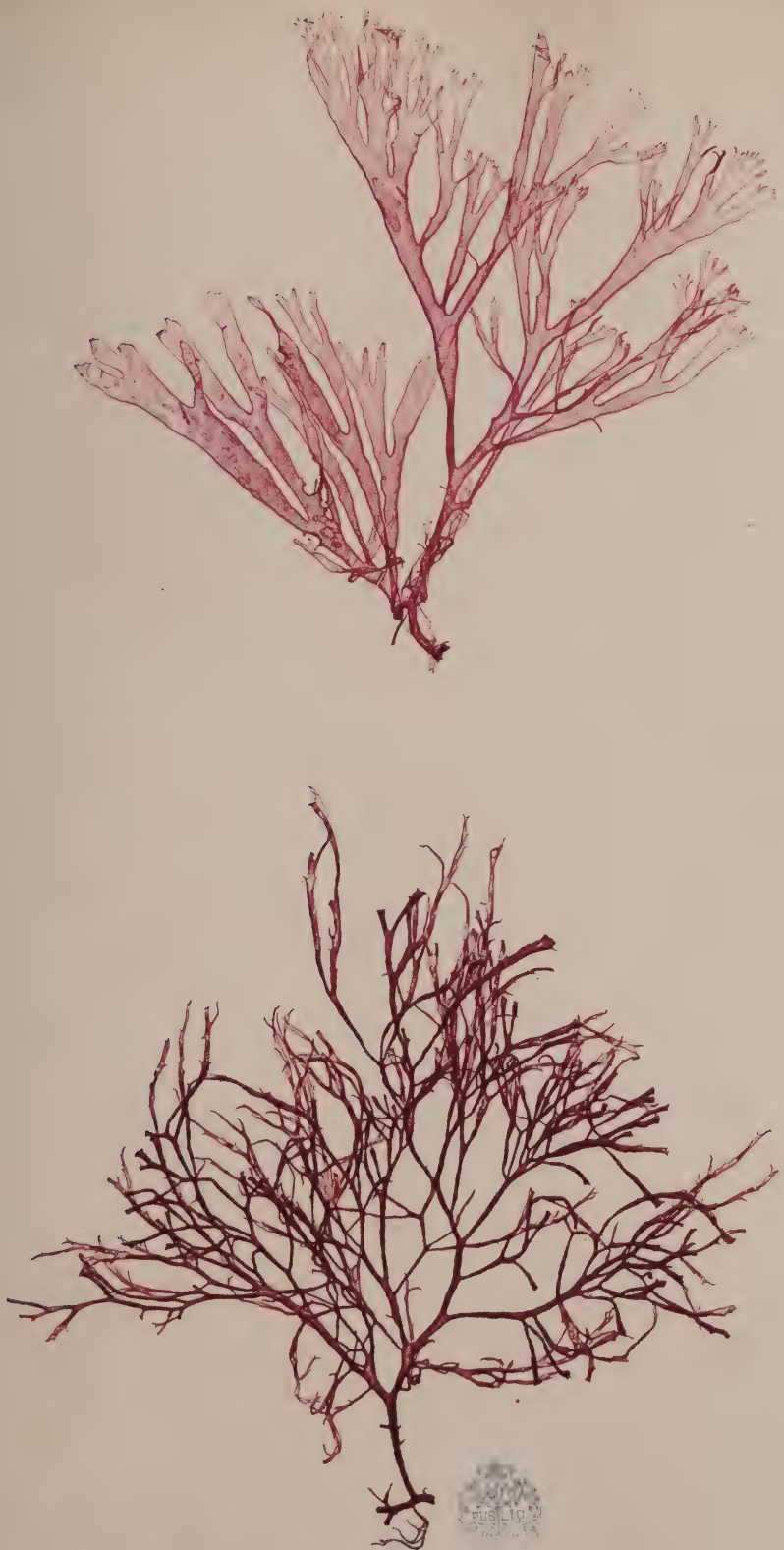
4



5

*Rhodymenia palmeta* Grev.

Lithographed by Henry Bradbury.



*Rhodymenia palmata* Grev.
*varieties.*

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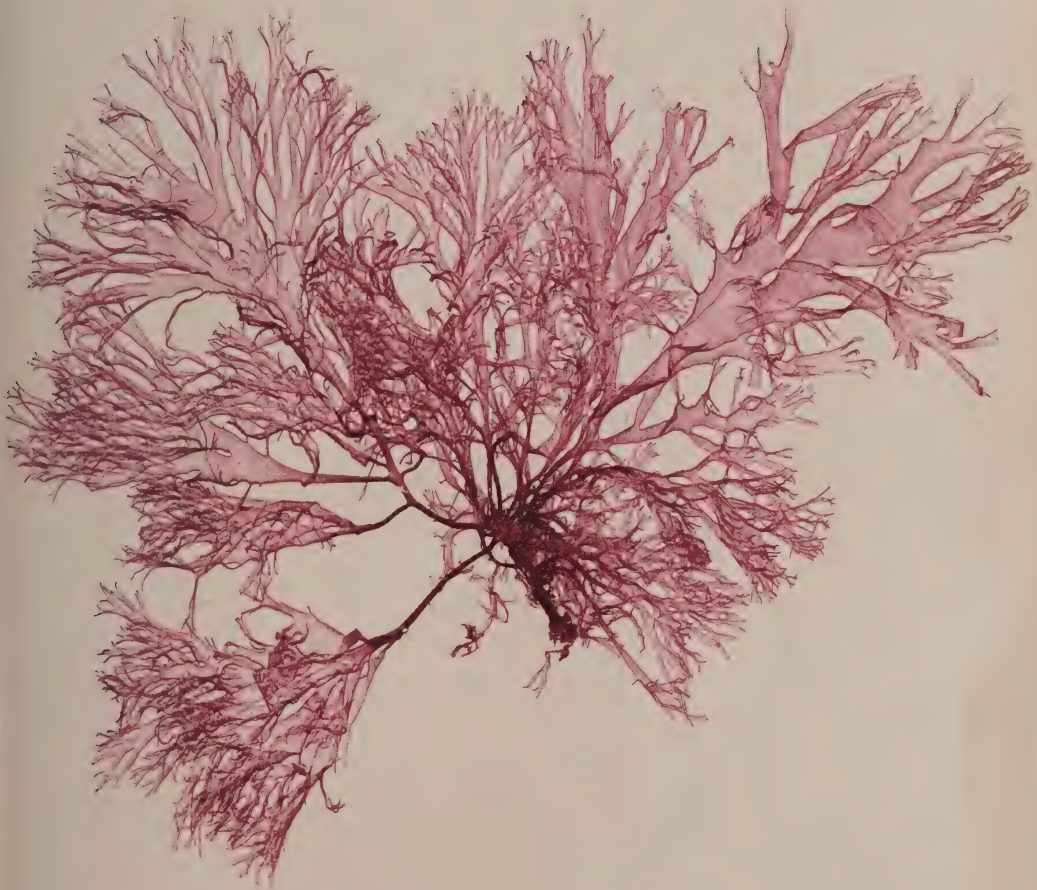

*Rhodymenia palmata*, Grev.
*variety.*

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# Plate LXXI.

## RHODOPHYLLIS BIFIDA.—*Kütz.*

Gen. Char.—Frond flat, membranaceous, cellular, without veins or midrib, much divided. Fructification of two kinds, on distinct plants: 1. Convex tubercles (coccidia), having a thick cellular pericarp, and inclosing a spherical mass of minute roundish or ovate spores, fixed by central placenta; 2. Tetraspores, zonate, roundish ovate, forming cloud-like sori in the upper segments. Name from *ῥοδον*, "a rose" perhaps, and *φύλλον*, "a leaf," from the rosy colour of the leaves or fronds.

Rhodophyllis *bifida.*—Frond delicate, membranous, flattened even from the base, dichotomously divided into many linear or obcuneate segments, their apices obtuse; tubercles almost spherical, sessile.

Rhodophyllis *bifida.—Kütz. Bot. Zeit.* 1847, p. 23; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 388.

Rhodymenia *bifida.—Grev. Alg. Brit.* p. 85; *Hook. Br. Fl.* vol. ii. p. 289; *Wyatt, Alg. Danm.* No. 66; *Endl.* 3rd Suppl. p. 51; *Harv.* in *Mack. Fl. Hib.* part 3, p. 194; *Harv. P. B.* plate 32; *Harv. Man.* p. 124; *Harv. Syn.* p. 103; *Atlas*, plate 40, fig. 183.

Delesseria *bifida.—Lamour. Ess.* p. 37.

Sphærococcus *bifidus.—Ag. Sp. Alg.* vol. i. p. 299; *Syst.* p. 231; *Kütz. Phyc. Gen.* p. 410.

Fucus *bifidus.—Goodw. & Woodw. Linn. Trans.* vol. iii. p. 159, t. 17, f. 1; *Sm. E. Bot.* t. 773; *Turn. Syn.* p. 165; *Turn. Hist.* t. 154.

Var. *β. ciliata.*—Frond opaque, dull red, narrow and much divided; margins fringed with leafy cilia.

Rhodymenia *bifida*, *β ciliata.—Harv. P. B.* plate 32, fig. 3; *Harv. Man.* p. 124.

Var. *γ. incrassata.*—Frond brownish red, broad; segments cuneate, ciliate at the margin.

Rhodymenia *bifida*, *γ incrassata.—Harv. P. B.* descp. plate 32.

Hab.—On rocks in the sea and on Algæ. Annual. Summer. Not uncommon on the southern shores of England and south and west of Ireland. Rare in Scotland. Ardrossan; Saltcoats; Kilbride (*Rev. Dr. Landsborough*).

Geogr. Dist.—Atlantic shores of Europe; Mediterranean Sea.

Description.—Root, a flattened disc, "accompanied by fibres." Fronds tufted, stem scarcely any, flat, immediately expanding into a roundish much-divided frond; segments erecto-patent or divaricate, one to three

inches in length, and the segments from half a line to half an inch, or nearly an inch, in breadth; axils mostly rounded, and apices obtuse or truncate, divisions more or less regularly dichotomous, sometimes palmate upwards, mostly very short and linear or obcuneate, the margin entire or slightly fringed with subfoliaceous ciliæ. Structure uniformly cellular, central cells rather small, roundish angular, those at the surface very minute. Tubercles subspherical, sessile, mostly placed along and just within the margin of the segments, apparently common, occasionally a few on the disc. Tetraspores apparently less common, forming cloud-like spots in the upper segments of the frond, oblong ovate, divided transversely into four segments, or sporules. Substance membranous, but rather firm and not adhering to paper in drying. Colour, a bright rosy red when fresh, but in some varieties becoming brownish when dry.

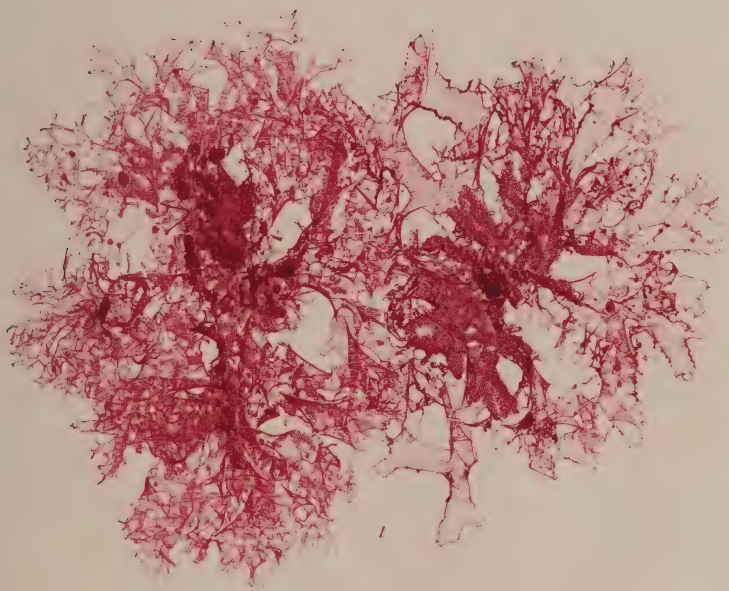
An extremely variable plant, in almost all its characters.

Mr. Moore has very kindly supplied us with specimens of both $\beta$ and $\gamma$, both abundantly furnished with tubercles. In variety $\gamma$, the segments are broad and considerably expanded upwards, much contracted in drying, and the colour has changed to a brownish orange. The margin is copiously furnished with simple or repeatedly divided leaflets. In variety $\beta$, the frond is much narrower, less divided; the upper segments mostly tapering to a point, and the margin more or less fringed with minute, setaceous, or somewhat leaf-like ciliæ, abundantly dotted with tubercles, especially in the less ciliated varieties, all round the margin of the segments.

Like many other species, this appears to be an ocean weed, and has not, so far as we know, been found growing on the east coast, being mostly confined to the south of England, and south and west of Scotland and Ireland.

EXPLANATION OF PLATE LXXI.

Fig. 1.—*Rhodophyllis bifida*, natural size.
2.—Segment with tubercles.
3.—Vertical section of a tubercle.
4.—Spores from same.
5.—Segment with tetraspores.
6.—Tetraspores. All magnified.



*Rhodophyllis bifida, Ag.*

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# Plate LXXII.

## EUTHORA CRISTATA.—*J. G. Ag.*

Gen. Char.—Frond membranaceous, flat, dichotomo-pinnate, composed of two strata of cells; those of the inner stratum oblong, large; of the outer coloured, minute, in few rows. Conceptacles marginal, sub-spherical, with a closed cellular pericarp (composed of concentrical layers of cellules at one point radiating); sporiferous filaments very numerous, radiating from a central placenta, which is suspended in the cavity of the pericarp by sub-simple filaments; the fertile spore-threads forming roundish masses of spores from their upper cells. Tetraspores cruciate, lodged in the thickened apices of the frond.

Euthora *cristata*.—Fronds membranaceous, much divided; divisions irregularly dichotomous, alternate or palmate, mostly linear or narrowed upwards; apices acute, laciniated or fimbriated; tubercles spherical, sessile; tetraspores collected in the upper segments.

Euthora *cristata*.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 385; *Harv. N. B. A.* part 2, p. 150.

Rhodymenia *cristata*.—*Grev. Alg. Brit.* p. 89; *Hook. Br. Fl.* vol. ii. p. 290; *Endl.* 3rd Suppl. p. 210; *Harv. P. B.* plate 307; *Harv. Man.* p. 126; *Harv. Syn.* p. 105; *Atlas*, plate 40, fig. 184.

Callophyllis *cristata*.—*Kütz. Sp. Alg.* p. 747.

Sphærococcus *cristatus*.—*Ag. Syn.* p. 29; *Lyngb. Hyd. Dan.* p. 13, t. 4; *Ag. Sp. Alg.* vol. i. p. 300; *Ag. Syst.* p. 231; *Hook. Fl. Scot.* part 2, p. 104; *Grev. Crypt. Scot.* t. 85; *Fl. Edin.* p. 296; *Kütz. Phyc. Gen.* p. 410.

Fucus *cristatus*.—*Herb. Linn.*; *Turn. Hist.* t. 23.

Fucus *gigartinus*.—*Fl. Dan.* t. 394; *Mohr, Hist. Isl.* p. 247; *Gunn. Fl. Norv.* p. 847.

Hab.—Growing on the roots and stems of *Laminariæ* in deep water. Very rare. Annual. Summer. Wick; Caithness; Orkney and Shetland; Frith of Forth (*Dr. Greville*); Berwick (*Dr. Johnstone*).

Geogr. Dist.—Arctic Sea; shores of the North of Europe; Iceland; eastern shores of North America.

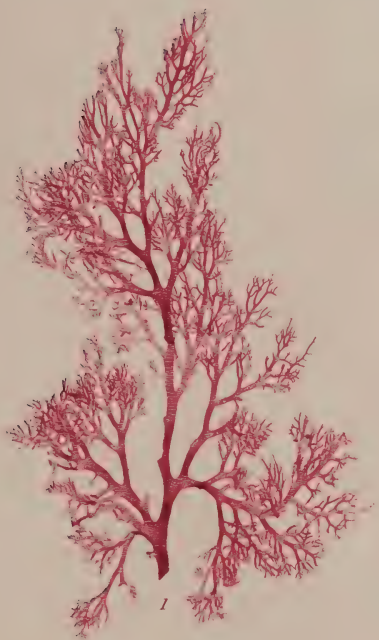
Description.—Root, a minute flattened disc. Fronds solitary or slightly tufted, from a very short subcompressed stem, suddenly expanding into a roundish subflabelliform flat frond, from half an inch to an inch and a-half in length, much divided in a subpalmate or subalternate manner; the branches generally short and bushy, frequently very irregular, mostly linear or narrowing upwards, or occasionally slightly

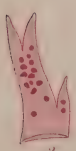
widening, the ultimate ones minute, mere laciniæ or teeth, often forming a beautiful fringe of minute ciliæ. Tubercles spherical, sessile, scattered along the margins of the frond, and containing a mass of conical spores. Tetraspores cruciate (?), forming patches near the extremities of the upper segments of plants whose divisions are narrower than those bearing tubercles. Structure cellular; central cells rather large, those at the surface very minute. Substance membranaceous, delicate, adhering to paper in drying. Colour, a bright crimson lake, not changing in drying.

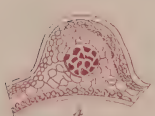
This beautiful species is extremely rare in this country, and always very stunted in its growth. Its centre of distribution seems to be the fine bays on the western shores of the North Atlantic, where it is frequently found in great abundance and of large size, often three times the size of any found on the shores of Britain. In this country it is quite a northern plant, being mostly confined to the northern shores of Scotland, and the Orkney and Shetland Islands, but everywhere scarce; still, however, exhibiting as many variations in form and ramification as the more luxuriant specimens from the Western World. At one time narrow, linear, repeatedly divided, the branches subpalmate or alternate, narrowed to the summits; at another once or twice divided, the segments broad, rounded, almost entire, with the apices multifid or laciniated.

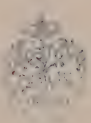
EXPLANATION OF PLATE LXXII.

Fig. 1.—*Euthora cristata*, natural size.
2.—Apices of laciniæ with tetraspores.
3.—Tetraspores.
4.—Section of a coccidium.
5.—Spores.
6.—Slice to show internal structure of frond. All magnified.









*Euthora cristata. J. G. Ag.*

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## CORDYLECLADIA ERECTA.—*J. G. Ag.*

Gen. Char.—Frond filiform, cartilaginous, of two distinct layers of cells : central large, roundish, smaller towards the surface ; outer minute, arranged in the form of vertical filaments. Fructification of two kinds, on distinct plants : 1. Tubercles (coccidia), containing a mass of minute spores attached to a central placenta ; 2. Tetraspores, quadrizonate, formed from the filaments of the periphery of pod-like receptacles.

Cordylecladia *erecta*.—Fronds much tufted, filiform, erect, sparingly dichotomous ; tubercles spherical, clustered on the branches ; tetraspores on terminal, pod-like receptacles.

Cordylecladia *erecta*.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 704.

Gracilaria *erecta*.—*Grev. Alg. Brit.* p. 124, t. 14 ; *Harv. P. B.* plate 177 ; *Harv. Man.* p. 130 ; *Harv. Syn.* p. 110 ; *Atlas*, plate 36, fig. 168.

Plocaria *erecta*.—*Endl.* 3rd Suppl. p. 51.

Gigartina *erecta*.—*Hook. Br. Fl.* vol. ii. p. 300 ; *Wyatt, Alg. Danm.* No. 115 ; *Harv.* in *Mack. Fl. Hib.* part 3, p. 200.

Sphærococcus *erectus*.—*Grev. Crypt.* t. 357.

Hab.—On sand-covered rocks in the sea. Perennial. Fruiting in winter. Very rare. Sidmouth ; Torquay (*Mrs. Griffiths*) ; Belfast Bay (*Mr. W. Thompson*) ; Port Balantrae (*Mr. D. Moore*) ; Roundstone (*M'Calla*) ; Orkney (*Rev. H. Pollexfen, Dr. M'Bain*).

Geogr. Dist.—Coast of France ?

Description. — Root, a broad flattened disc. Fronds numerous, clustered, slender, filiform, erect, one to three inches high, one-fourth to one-half a line in diameter, very sparingly branched ; branches erect, irregularly dichotomous ; axils acute, the apices gradually tapering to a point. Structure cellular, central cells large, smaller outwards, outer coating distinct, arranged in the form of vertical closely-packed filaments, composed of minute coloured cells. Substance cartilaginous, very rigid, not adhering to paper in drying. Colour, a dark brownish red, dark brownish black when dry. Tubercles clustered round the upper branches, spherical, sessile, containing, within a thick pericarp formed of the surface of the frond, a dense mass of obconical spores. Tetraspores imbedded among the surface-cells of pod-like, lanceolate, terminal, binate receptacles, zonately divided into four sporules.

This interesting little plant is perhaps less sparingly distributed than

has generally been supposed, being, from its plain garb and unassuming appearance, very likely often to be overlooked. We have not met with it, and do not know of its having been found on the east coast; the only ascertained habitats being on the south-west coast of England, several stations on the Irish coast, and the Orkney Islands (*Lieut. Thomas,* in *Phyc. Brit.*) It is curious, however, to observe that these are all regular hunting grounds, and no doubt, were other parts of our coasts equally well examined, other stations would be found.

When not in fruit it is no easy matter to distinguish this from *Gracilaria confervoides,* even under the microscope, its somewhat brighter colour, and a slight difference in structure, being by no means certain; when well fruited, however, no such difficulty exists, and the two may be readily separated. It should be carefully looked for in rock-pools near low-water mark, especially in such as are partially bedded with sand, in which it has no objections to be partially buried.

CORDYLECLADIA ERECTA.

EXPLANATION OF DISSECTIONS, &c.

Fig. 1.—*Cordylecladia erecta,* natural size.
2.—Pods.
3.—Transverse section of a pod with tetraspores.
4.—A tetraspore.
5.—Branches with tubercles.
6.—Transverse section of branch and tubercle. All magnified.

# Plate LXXIII.

## STENOGRAMME INTERRUPTA.—*Mont.*

Gen. Char.—Frond flat, nerveless, cellular; central cells large, transparent, and colourless, those near the surface small, coloured. Fructification: 1. "Linear, convex, nervelike conceptacles, containing a dense mass of minute spores" (*Harvey*). 2. Tetraspores, unknown. Name from στενὸς, "narrow," and γραμμὴ, "a line;" alluding to the linear fructification.

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Stenogramme *interrupta*.—*Mont.* in *Duchart. Rev. Bot.* 1846, p. 483; *Harv. P. B.* plate 157; *Harv. Man.* p. 124; *Harv. Syn.* p. 103; *Atlas*, plate 36, fig. 167; *Harv. N. B. A.* part 2, p. 163; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 391.

Stenogramme *Europea*.—*Harv.* in *Herb.* 1847.

Delesseria *interrupta*.—*Ag. Sp. Alg.* vol. i. p. 179; *Ag. Syst.* p. 250; *Mont.* in *Webb, Ot. Hisp.* p. 15, t. 8; *Endl.* 3rd Suppl. p. 53.

Hab.—Among rejectamenta. November. Very rare. Bovisand, near Plymouth (*Dr. J. Cocks*); Mt. Edgecombe (*Rev. W. S. Hore*).

Geogr. Dist.—Cadiz; Cabrera; Plymouth Harbour?

Description.—Root, a small flat conical disc. Frond flat, membranaceous. Stem short, three to six lines long, suddenly expanding into a roundish frond, three to five inches in height; four to five times divided in a more or less regularly dichotomous manner, into narrow segments, which are linear, erect, but with rounded axils, and obtuse rounded apices; width nearly uniform in the same specimen, but varying in different specimens from three to six lines. In some specimens the divisions extend almost to the base, while in others the lower third or nearly one-half is quite entire, while the rest is divided into narrow laciniæ. Sometimes one or all of the segments have been accidentally torn off, and one or more proliferous elongations arise from the summit, which become dichotomous like the rest. "The margin, which is usually quite flat and very entire, sometimes throws out minute, lobed, and somewhat fringed processes."—*Harvey*. Fructification, consisting of linear conceptacles occupying the centre of the frond in the manner of a midrib, but never continuous, being always interrupted about the axils, commencing opposite, a little below or in the lower parts of the frond, a little above the axil, and, proceeding along the middle of the frond, terminates about a quarter of an inch below the fork or axil imme-

diately above; between this point and the axil other two conceptacles commence and proceed along the middle of the two succeeding divisions to the next axil, and so on, every branch of the frond generally becoming fertile, barren fronds being much less common than fertile ones. The central portion of this conceptacle eventually becomes enlarged, either in one or more portions, forming an oblong continuous or interrupted series of more or less spherical receptacles, filled with minute somewhat angular spores. Tetraspores forming well-defined spots (sori) on the surface of the frond.—*Miss Gifford.* Structure composed of two strata of cells, those forming the central portion large, roundish, hexagonal, and apparently empty; those forming the surface-stratum minute and coloured. Substance rather firm and cartilaginous, rather imperfectly adhering to paper in drying, unless after steeping for some time in fresh water. Colour, a fine clear pink, passing into yellowish green in decay.

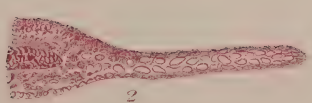
This beautiful species was added to the British Flora in 1847, being discovered by Dr. Cocks, of Plymouth, and very soon after by the Rev. W. S. Hore. Since then it has been occasionally picked up on the south and south-west coasts of England, but never in any abundance, and only among rejectamenta, so that its true habitat is still unknown.

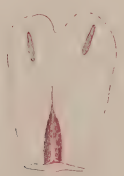
We have seen no tetraspores nor any really barren specimens. Such are described as being entirely without nerve or midrib. In all our specimens conceptacles are more or less developed, and in those segments where no conceptacle is apparent externally, still there is an evident difference in the central cells, where they are smaller, more condensed, and somewhat coloured. This, however, may only be the incipient fructification, and it would be very desirable to ascertain whether the large empty cells of the centre extend the whole breadth of the frond, or whether the central portion of the frond is not occupied from the first with smaller, more dense, and perhaps coloured cells, in some measure analogous to a midrib; and if not, the conversion of the large coloured cells of the centre into the minute, compact, coloured cells of the conceptacle, would still be an interesting subject of inquiry.

In our specimens the formation of the conceptacle commences with the bifurcation of the frond, and its growth proceeds simultaneously with the segments, terminating when these begin to widen for the formation of a new fork.

EXPLANATION OF PLATE LXXIII.

Fig. 1. *Stenogramme interrupta*, natural size.—2. Semi-section of frond.—3. Apex of segment with conceptacles.—4. Spores from same. All magnified.



*STENOGRAMME interrupta, MONT.*

Nichols Printed by Henry Bradbury.

# Plate LXXIV.

## DUMONTIA FILIFORMIS.—*Grev.*

Gen. Char.—Frond filiform; when old tubular, when young, more or less filled in the centre with delicate anastomosing filaments; the walls of the tube composed of three strata, inner of longitudinal, articulated, anastomosing filaments, densely interwoven; from these arise other similar short, dichotomous, vertical filaments.

Dumontia *filiformis.*—Frond filiform, attenuated at each end, and emitting on all sides, irregularly from its lower half, long slender branches, tapering to a narrow point, and much attenuated to the base like the main stem. Favellæ and tetraspores formed by the metamorphosis of the dichotomous filaments.

Dumontia *filiformis.*—*Grev. Alg. Brit.* p. 165, t. 17; *Hook. Br. Fl.* vol. ii. p. 308; *Wyatt, Alg. Danm.* No. 31; *Hook. fil. Fl. Ant.* part 1, p. 189; *Kütz. Phyc. Gen.* p. 394, t. 74, f. 2; *Endl.* 3rd Suppl. p. 39; *Harv.* in *Mack. Fl. Hib.* part 3, p. 188; *Harv. P. B.* plate 59; *Harv. Man.* p. 147; *Harv. Syn.* p. 121; *Atlas*, plate 46, fig. 209; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 348.

Dumontia *incrassata.*—*Lam. Ess.* p. 45.

Halymenia *filiformis.*—*Ag. Sp. Alg.* vol. i. p. 214; *Ag. Syst.* p. 245.

Chondria *purpurascens.*—*Grev. Fl. Edin.* p. 290.

Gastridium *filiforme.*—*Lyngb. Hyd. Dan.* p. 68, t. 17.

Conferva *filiformis.*—*Fl. Dan.* t. 1480, f. 2.

Ulva *filiformis.*—*Wahl. Fl. Lapp.* p. 508.

Var. β. *crispata.*—Frond compressed, curled and twisted.

Dumontia *filiformis*, β *crispata.*—*Grev. Alg. Brit.* p. 165; *Harv.* l. c.; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 350.

Halymenia *purpurascens*, β *crispata.*—*Grev. Crypt.* t. 240.

Hab.—On rocks, stones, old shells, &c., in the sea. Annual. Summer. β in places exposed to tidal currents. Common.

Geogr. Dist.—Shores of Europe; Southern Ocean.

Description.—Root, a minute disc. Fronds tufted, filiform, six to twenty-four inches in length, and one to six lines in diameter, much-branched from near the base to the middle; branches simple, long, slender, and, as well as the frond, much attenuated to the base, and tapering to a long slender point. The branching is often very irregular, sometimes being confined to the base, and at others entirely to the

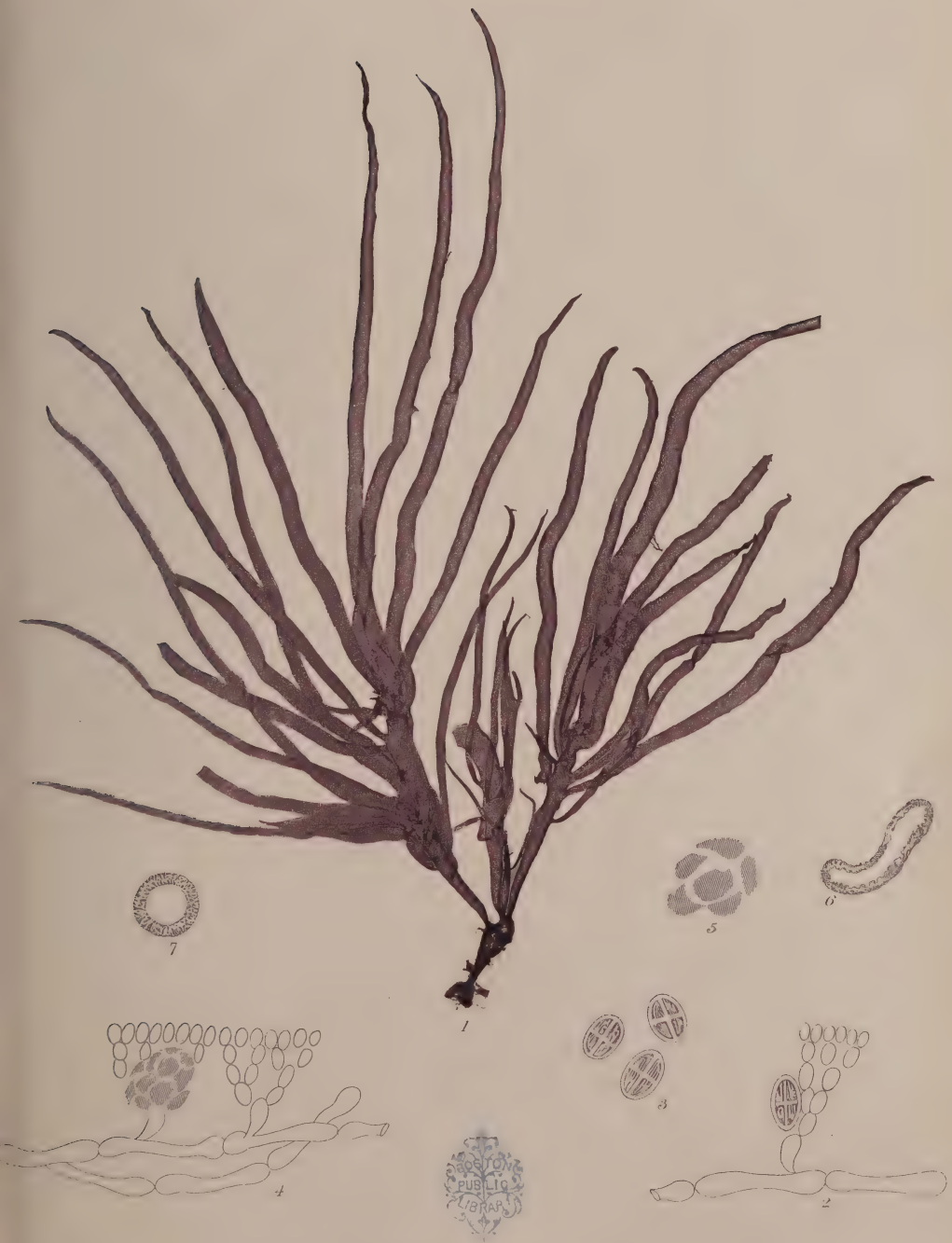
summit; sometimes a branch becomes elongated and branched in its turn like the main stem, but generally the branches are quite simple, generally much smaller, but occasionally much more developed than the main stem, which is at times short and slender, or thick and truncated. Sometimes all the parts are long, slender, cylindrical, smooth and even on the surface; at other times, as in var. $\beta$, the stem and branches are greatly thickened about or a little below the middle, more or less compressed, wrinkled, often more or less twisted in a regular spiral. Structure, when young, composed internally of an exceedingly lax network of hyaline, anastomosing, jointed filaments; joints contracted in the middle, four to six times longer than broad, extremely lax in the centre, more dense outward; the central portion disappearing with the growth of the plant, the outer portion forming a very lax lining to the now tubular frond, and from the outer filaments arising the vertical, dichotomous, jointed filaments, that constitute the main body of the frond. These are lax at first, but by rapid and repeated subdivision become denser at the circumference, forming a close stratum of moniliform cells. Substance soft and lubricous, adhering very closely to paper. Favellæ formed by the metamorphosis of the dichotomous filaments, and placed at their base, containing numerous angular spores. Tetraspores cruciate, similarly formed and situate.

This curious plant is a very common inhabitant of our tide-pools all round the coast. The variety $\beta$ seems to grow in greatest luxuriance, and to exhibit its peculiar characteristics in estuaries where the water is somewhat brackish. In such places it often reaches a large size, but the smooth cylindrical fronds may be observed growing from the same tufts as the wrinkled ones; the larger ones being generally of a paler colour.

The appearance and disappearance of sea-weeds is often very curious. We have gathered this plant in abundance in the beginning of June, and in the same pools by the middle of the month not a vestige could be found, although the weather had been perfectly calm all the time. We have often observed the same circumstance with respect to other Algæ, and to such an extent as to add vastly to the interest which the marine botanist will derive from visiting frequently even the same part of the coast.

EXPLANATION OF PLATE LXXIV.

Fig. 1.—*Dumontia filiformis*, natural size.
2.—Filaments of the periphery with tetraspore.
3.—Tetraspores.
4.—Filaments with a favella.
5.—Spores from same.
6.—Section of variety $\beta$.
7.—Section of normal state. All magnified.



*Dermonema filiformis. Grev.*

Nature Printed by Henry Bradbury.

## CATENELLA OPUNTIA.—*Grev.*

Gen. Char.—Frond filiform, constricted, solid, the central portion composed of a very lax network of delicate, anastomosing, jointed filaments, from which arise vertical jointed, dichotomous filaments, forming the outer stratum, very dense at the surface. Fructification of two kinds, on distinct plants: 1. Capsules, formed by the metamorphosis of the ramuli, and containing a mass of minute angular spores; 2. Tetraspores, zonate, immersed among the dichotomous filaments and formed by their metamorphosis. Name from *catenella*, diminutive of *catena*, "a chain."

Catenella *opuntia*.—Fronds arising from creeping filaments, densely tufted, constricted; branches few, irregular.

Catenella *opuntia*.—*Grev. Alg. Brit.* p. 166, t. 17; *Hook. Br. Fl.* vol. ii. p. 309; *Wyatt, Alg. Danm.* No. 126; *J. Ag. Alg. Medit.* p. 89; *Endl.* 3rd Suppl. p. 37; *Kütz. Phyc. Gen.* p. 394, t. 76, f. 4; *Harv.* in *Mack. Fl. Hib.* part 3, p. 188; *Harv. P. B.* plate 88; *Harv. Man.* p. 151; *Harv. Syn.* p. 124; *Atlas*, plate 44, fig. 204.

Chordaria *opuntia*.—*Spreng. Syst. Veg.* vol. iv. p. 330.

Lomentaria *opuntia*.—*Gaill. Dict. Hist. Nat.* vol. liii. p. 367.

Halymenia ? *opuntia*.—*Ag. Sp. Alg.* vol. i. p. 217; *Syst.* p. 245.

Chondria *opuntia*.—*Hook. Fl. Scot.* part 2, p. 106; *Grev. Fl. Edin.* p. 292.

Gigartina *opuntia*.—*Lamour. Ess.* p. 49.

Gigartina *pilosa*.—*Lamour.* l. c. p. 49 (sec. *Ag.*).

Rivularia *opuntia*.—*Gm. Eng. Bot.* t. 1868.

Fucus *opuntia*.—*Good. & Woodv.* in *Linn. Trans.* vol. iii. p. 219; *Stack. Ner. Brit.* p. 104, t. 16; *Turn. Syn. Fuc.* vol. ii. p. 387; *Turn. Hist.* t. 107.

Fucus *repens*.—*Lightf. Fl. Scot.* vol. ii. p. 961; *With.* vol. iv. p. 91.

Fucus *cæspitosus*.—*Stack. Ner. Brit.* p. 59, t. 12.

Ulva *articulata*, β.—*Huds. Fl. Angl.* p. 569.

Hab.—On rocks, &c., near high-water mark. Perennial. Common, but rare in fruit.

Geogr. Dist.—Atlantic shores of France and Spain; Mediterranean Sea; New Zealand (*Dr. Hooker*).

Description.—Roots composed of creeping, branched filaments. Fronds, arising from these, filiform, constricted at intervals of from half a line to a line, from half an inch to an inch in height, densely tufted, forming continuous patches, often spreading over a considerable surface, sparingly branched; branches arising immediately under the constriction, mostly opposite, or solitary, sometimes again once or twice divided in

a similar sparing manner. Structure as in the generic character. Substance somewhat flaccid and partially adhering to paper. Colour a dull purple. Capsules, each formed by the metamorphosis of a branchlet, furnished with a terminal pore, and containing a mass of minute spores, "the walls formed of moniliform filaments; the mass of spores appears to be formed by the transformation of the internal network" (*Harvey*). Tetraspores quadripartite, zonate, immersed among the dichotomous filaments, by the metamorphoses of which they are produced.

This singular little plant seems to be very generally distributed round our shores, but to be nowhere found in abundance, and very rarely producing fruit. On the Forfarshire coast we have only found it in one spot, where however it is in considerable plenty. It grows under the shade of a projecting ledge in a somewhat cavernous hollow, where it can scarcely ever see the sun. The specimens are very fine; but we have not been able to find any fruit.

The external habit is very much that of a dwarf specimen of *Chylocladia articulata*, but the dark red, almost black colour will at once distinguish them, even without an appeal to the microscope, when there can be no mistaking it.

CATENELLA OPUNTIA.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branch with tetraspores.
2.—Filament of the periphery with tetraspores.
3.—Tetraspores.
4.—Branchlet with ceramidium.
5.—Spores.
6.—Longitudinal section of —— ? All magnified.

# Plate LXXV.

## CHYLOCLADIA ARTICULATA.—*Grev.*

Gen. Char.—Frond gelatinoso-membranaceous, cylindrical or compressed, continuous or constricted, as if jointed; the cavity occupied by a thin watery fluid, and traversed longitudinally by a few slender-jointed fibres; periphery consisting of small oblong cells, smaller towards the surface. Fructification of two kinds, on distinct plants: 1. Ceramidia, sessile on the upper ramuli; 2. Tetraspores, tripartite, imbedded in the upper ramuli. Name from χυλὸς, "juice;" and κλάδος, "a branch," referring to the structure.

Chylocladia *articulata.*—Frond tubular, very much constricted, and branched from the constrictions; naked below, pinnate or dichotomous upwards, frequently fastigiate; capsules conical, truncate, with a terminal pore.

Chylocladia *articulata.*—*Grev.* in *Hook. Br. Fl.* vol. ii. p. 298; *Wyatt, Alg. Danm.* No. 73; *Harv.* in *Mack. Fl. Hib.* part 3, p. 200; *Harv. P. B.* plate 283; *Harv. Man.* p. 102; *Harv. Syn.* p. 88; *Atlas*, plate 33, fig. 147.

Lomentaria *articulata.*—*Lyngb. Hyd. Dan.* p. 101, t. 30; *Endl.* 3rd Suppl. p. 43; *Kütz. Phyc. Gen.* p. 441.

Chondria *articulata.*—*Ag. Sp. Alg.* vol. i. p. 357; *Grev. Fl. Ed.* p. 291; *Spreng. Syst. Veg.* vol. iv. p. 342.

Gigartina *articulata.*—*Lamour. Ess.* p. 49.

Fucus *sericeus*, var.—*Esper, Ic. Fuc.* vol. i. t. 82.

Fucus *articulatus.*—*Lightf. Fl. Scot.* p. 959; *Smith, E. Bot.* t. 1574; *Stack. Ner. Brit.* p. 28, t. 8; *Turn. Syn.* p. 383; *Turn. Hist.* t. 106.

Ulva *articulata.*—*Huds. Fl. Angl.* p. 569.

Hab.—On rocks and Algæ, between tide-marks. Annual. Summer. Common.

Geogr. Dist.—Atlantic and Mediterranean shores of Europe.

Description.—Root composed of branching fibres. Frond two to ten inches in length, about a line in breadth, tubular throughout, and filled with a watery fluid, the tube longitudinally traversed by a few fibres, and very much constricted; five to six or seven times pinnated, or occasionally dichotomous, especially towards the summit, where the branches often become fascicled or whorled; the lower joints three to five times longer than broad, shorter upwards, oblong, obovate or elliptical; the ultimate ones roundish. Structure: central tube large, traversed longitudinally by a few filaments; outer cells small, the inner

ones larger. Substance soft and flaccid, closely adhering to paper in drying. Capsules rather large, "conical," with flat base; mouth suddenly narrowed, truncate, perforated by a terminal pore for the escape of the spores. Tetraspores triparted, imbedded in the uppermost branches. Colour a purplish red, frequently much varied, often bright and transparent, not changing much in drying.

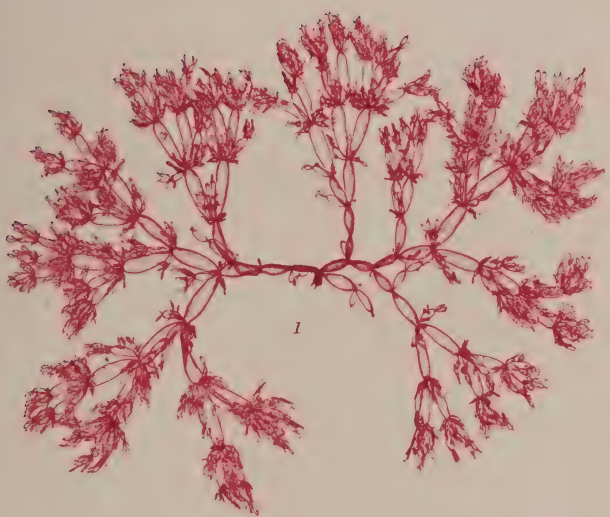
One of our most common and most beautiful Algæ, occurring in greater or less abundance almost on every shore, and frequently forming a light, brightly-coloured, and often variegated drapery on the otherwise naked sides of isolated rocks.

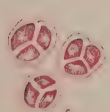
Although pretty constant to its more minute characters, it is nevertheless subject to considerable variation in its ramification; at one time so excessively branched as to form a round inextricable mass, while at other times it is so vaguely and sparingly divided, that one would at first sight take it for a different species. It is a very common plant on all our rocky coasts, but the fruit is by no means abundant; the tetraspores are more frequent than the capsules, generally extending down into the principal branches, and when they do occur are generally abundant.

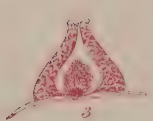
Small specimens of this plant have a great resemblance to *Catenella opuntia*, but the likeness is only external; even the colour is in general a sufficient distinction, being in the present species a more or less bright transparent red, and in *Catenella* a brownish purple. In the microscope, the structure will be found quite different, as also the fruit, especially the tetraspores, which in the present are triparted, in *Catenella* zonate.

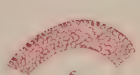
EXPLANATION OF PLATE LXXV.

Fig. 1.—*Chylocladia articulata*, natural size.
2.—Branch with ceramidia.
3.—Section of a ceramidium.
4.—Branch with tetraspores.
5.—Tetraspores.
6.—Section of frond. All magnified.







*Chylocladia articulata*, Grev.

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# Plate LXXVI.

## CHYLOCLADIA CLAVELLOSA.—*Grev.*

Gen. Char.—Frond gelatinoso-membranaceous, cylindrical or compressed, continuous or constricted, as if jointed; the cavity occupied by a thin watery fluid, and traversed longitudinally by a few slender-jointed fibres; periphery consisting of small oblong cells, smaller towards the surface. Fructification of two kinds, on distinct plants: 1. Ceramidia, sessile on the upper ramuli; 2. Tetraspores, tripartite, imbedded in the upper ramuli. Name from χυλὸς, "juice;" and κλάδος, "a branch," referring to the structure.

Chylocladia *clavellosa*.—Frond subfiliform, gelatinous, mostly distichous, three to four times pinnate; all the divisions very irregular in size and branching, and attenuated at each end; capsules sessile, short, urceolate.

Chylocladia *clavellosa*.—*Grev. Hook. Br. Fl.* vol. ii. p. 297; *Wyatt, Alg. Danm.* No. 23; *Harv.* in *Mack. Fl. Hib.* part 3, p. 199; *Harv. Man.* 1st edit. p. 71; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 366.

Chrysymenia *clavellosa*.—*J. Ag. Alg. Medit.* p. 107; *Endl.* 3rd Suppl. p. 42; *Harv. P. B.* plate 114; *Harv. Man.* p. 100; *Harv. Syn.* p. 85; *Atlas*, plate 30, fig. 136.

Chondrothamnion *clavellosum*.—*Kütz. Phyc. Gen.* p. 438, t. 53, f. 2.

Chondrothamnion *confertum*.—*De Not.*

Gastridium *clavellosum*.—*Lyngb. Hyd. Dan.* p. 70, t. 17; *Grev. Alg. Brit.* p. 115.

Gastridium *purpurascens*.—*Lyngb.* l. c. p. 69, t. 17.

Chondria *clavellosa*.—*Ag. Sp. Alg.* vol. i. p. 353; *Ag. Syst.* p. 206; *Hook. Fl. Scot.* part 2, p. 105; *Grev. Fl. Edin.* p. 291; *Spreng. Syst. Veg.* vol. iv. p. 342.

Gigartina *clavellosa*.—*Lamour. Ess.* p. 49.

Fucus *clavellosus*.—*Turn.* in *Linn. Trans.* vol. vi. p. 133, t. 9; *Turn. Syn.* p. 373; *Turn. Hist. Fuc.* t. 30; *Sm. Eng. Bot.* t. 1203.

Hab.—On rocks, stones, old shells, on the stems of *Laminariæ* as well as some of the smaller Algæ, near low water and at a greater depth. Annual. Spring, summer, and autumn. Common.

Geogr. Dist.—Atlantic shores of Europe; Baltic and Mediterranean Seas; Tasmania.

Description.—Root, a minute conical disc. Frond gelatinous, subfiliform, three to twelve inches long, and about a line in thickness in the middle, very much branched (from near the base) in a distichous manner, three to four times pinnated; branches very irregular in size,

ramification, sometimes simple, to three or four times pinnated; divisions either alternate or opposite, longest about the middle, all very much attenuated at each extremity. The primary tendency of the branches is to be distichous, but innovations are often produced on every part of the stem and branches, so that in old plants the branching is often rather irregular and crowded, and Dr. Harvey also notices some varieties in which the stem is nearly naked, with a few very long, virgate branches, much longer than the stem itself, which are clothed with slightly compound ramuli, half an inch long; and others in which the whole plant is so densely crowded, and excessively compound, that the plant becomes a matted ball, so dense that it becomes difficult to trace its branching. Structure: central tube large, traversed by a few very delicate inner cells, very large, oblong, becoming rounder and smaller towards the circumference, where they are very minute. Substance gelatinous, very flaccid, soon decomposing in fresh water, and closely adhering to paper. Colour, a fine transparent pink, often rather pale, sometimes brownish, rather darker when dry. Ceramidia urceolate, with a short mouth and flattened base, not uncommon, containing a dense mass of very minute angular spores. Tetraspores triparted, immersed in the ultimate ramuli, also common.

This species is by no means uncommon on all parts of the coast, seeming to prefer a flat shelving shore, with a hard stony bottom, where it grows attached to stones, old shells, and even to other Algæ.

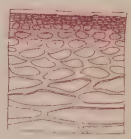
The genus *Chrysymenia* is distinguished from *Chylocladia*, with which it was formerly associated, by the continuous central tube, and some slight differences of habit.

From *Chylocladia kaliformis*, with which it was confounded by the earlier botanists, it may be readily known by the internal continuous tube, and the external corresponding constrictions so conspicuous in that species, as well as by the very different form of the capsular fruit. Both may be often found growing together, as they affect similar localities.

Besides the varieties noticed in the description, we have one from the Moray Frith, in which all the lower parts of the branches are naked; all the branchlets being collected in dense fascicles at their summits, giving the plant a very curious brush-like appearance.

EXPLANATION OF PLATE LXXVI.

Fig. 1.—*Chyclocladia clavellosa*, natural size.
2.—Branch with capsule.
3.—Branch with tetraspores.
4.—Tetraspores.
5.—Longitudinal semi-section of stem.
6.—Cross section of segment of same. All magnified.



*CHYLOCLADIA clavellosa, Ag.*

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# Plate LXXVII.

## CHYLOCLADIA ROSEA.—*Harv.*

Gen. Char.—Frond gelatinoso-membranaceous, cylindrical or compressed, continuous or constricted, as if jointed; the cavity occupied by a thin watery fluid, and traversed longitudinally by a few slender-jointed fibres; periphery consisting of small oblong cells, smaller towards the surface. Fructification of two kinds, on distinct plants: 1. Ceramidia, sessile on the upper ramuli; 2. Tetraspores, tripartite, imbedded in the upper ramuli. Name from χυλὸς, "juice," and κλάδος, "a branch," referring to the structure.

Chylocladia *rosea*.—Fronds very much compressed, two or three times pinnated, all the divisions elliptic-oblong, distichous, opposite or nearly so. Tetraspores tripartite, immersed in the disc of the pinnules.

Chylocladia *rosea*.—*Harv. N. B. A.* part 2, p. 187.

Chrysymenia *rosea*, var. *Orcadensis*.—*Harv. P. B.* plates 301 & 358 a.

Chrysymenia *Orcadensis*.—*Harv. Man.* p. 100.

Chrysymenia *rosea*.—*Harv. Syn.* p. 86; *Atlas*, plate 31, figs. 141, 142.

Hab.—"Rocks and Algæ in deep water." Plymouth; Sanda-frith and Skaill, Orkney.

Geogr. Dist.—Only known as above.

Description.—Root composed of branching fibres. Frond very much compressed, hollow, half an inch to one and a-half inch in height; two to four lines in breadth, once or twice pinnated, with mostly opposite, distichous, elliptic-oblong, obtuse divisions, exactly similar to the primary frond, at first ovate or elliptic, becoming more oblong as they advance in age. Structure: inner cells large, smaller towards the circumference, where they are very minute. Substance very flaccid, and closely adhering to paper. Colour, a fine rose red, not changing in drying. Capsules unknown. Tetraspores tripartite, immersed in the disc of the pinnules.

We have not seen either Orkney or Filey specimens of this plant; but Plymouth specimens are exactly similar to the figure, Plate CCCI. in *Phyc. Brit.*, except that ours are covered with tetraspores. These however do not seem to be so much collected into sori as represented in the Filey specimens, but are scattered over the whole of the middle portion of the frond, extending nearly to the edges, but here and there collected more densely than in other places.

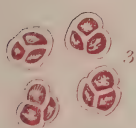
Our fronds are hardly so regularly oppositely pinnated as the figures in *Phyc. Brit.*, one of the pairs being frequently wanting.

There seems not the least risk of confounding this species with *Chylocladia clavellosa*, its small size, and very much broader fronds and divisions, will readily distinguish them. In our specimens, the lower third of the primary frond is destitute of pinnæ; these being confined to the upper two-thirds, giving the frond a somewhat flabellate appearance.

EXPLANATION OF PLATE LXXVII.

Fig. 1.—*Chylocladia rosea*, natural size.
2.—Leaflet with tetraspores.
3.—Tetraspores from same.
4.—Section of frond. All magnified.

1



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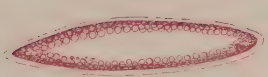

4

2

*Chylocladia rosea*, Harv.

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# Plate LXXVIII.

## PHYLLOPHORA RUBENS.—*Grev.*

Gen. Char.—Frond flat, rigid, nerveless, uniformly cellular; cells minute, roundish angular. Fructification: "1. Tubercles (favellidia), scattered over the surface of the frond, and containing a mass of minute roundish or angular spores; 2. Warts (nemathecia), seated on the frond, and composed of radiating moniliform filaments, whose lower articulations are at length converted into spores? 3. Tetraspores, on distinct plants, collected into sori, either towards the apex of the frond, or in proper leaflets."—*Harvey.* Name from φύλλον, "a leaf," and φορέω, "to bear."

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Phyllophora *rubens.*—*Grev. Alg. Brit.* p. 135, t. 15; *Hook. Br. Fl.* vol. ii. p. 303; *Wyatt, Alg. Danm.* No. 29; *Endl.* 3rd Suppl. p. 38; *Kütz. Phyc. Gen.* p. 412; *Harv.* in *Mack. Fl. Hib.* part 3, p. 202; *Harv. P. B.* plate 131; *Harv. Man.* p. 142; *Harv. Syn.* p. 116; *Atlas,* plate 45, fig. 205.

Sphærococcus *rubens.*—*Ag. Sp. Alg.* vol. i. p. 237; *Ag. Syst.* p. 213; *Hook. Fl. Scot.* part 2, p. 102; *Grev. Fl. Edin.* p. 296; *Spreng. Syst. Veg.* vol. iv. p. 335.

Chondrus *rubens.*—*Lyngb. Hyd. Dan.* p. 18.

Delesseria *rubens.*—*Lamour. Ess.* p. 38.

Fucus *rubens.*—*Linn. Sp. Pl.* p. 1630; *Good. & Woodw.* in *Linn. Trans.* vol. iii. p. 165; *Turn. Syn.* vol. ii. p. 216; *Turn. Hist.* t. 12; *E. Bot.* t. 1053; *Stack. Ner. Brit.* 2nd edit. t. 19; *Hook. Iceland Tour,* vol. ii. p. 347.

Fucus *prolifer.*—*Lightf. Fl. Scot.* p. 949, t. 30; *Esper, Ic. Fuc.* t. 129.

Fucus *epiphyllus.*—*Fl. Dan.* t. 708.

Fucus *crispus.*—*Huds. Fl. Angl.* p. 580.

Hab.—On rocks, stones, shells, &c., beyond tide-mark to 20 fathoms; also in shady rock-pools. Perennial. Winter. Not uncommon.

Geogr. Dist.—Atlantic coasts of Europe. Baltic Sea.

Description.—Root, a broad flattened disc. Frond scarcely stalked, linear or obcuneate, two to eight inches high, simple, or two to three times dichotomous, and repeatedly proliferous, from the imperfectly formed midrib, with frondlets similar to the parent; all the divisions linear or linear-obcuneate, with rounded axils, and obtuse, rounded or truncate tips, about an inch in length, and a quarter of an inch in breadth, but often of greater size. Structure uniformly cellular; central cells small, still smaller towards the circumference, where they are very minute. Sub-

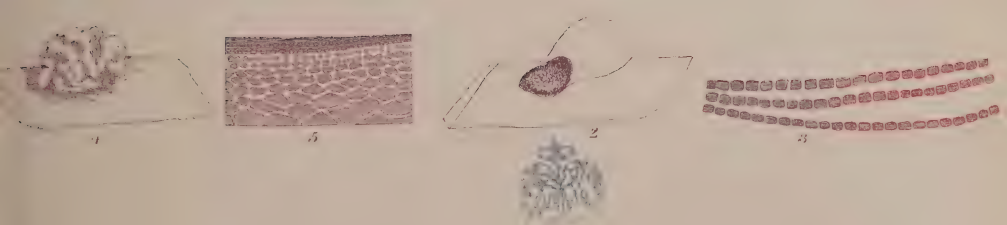
stance firm and rigid, not adhering to paper in drying. Colour, a fine deep or bright transparent red, becoming brighter in fresh water, or when exposed to the air, passing into greenish yellow in decay. Tubercles "densely scattered over the surface of the frond, or forming lines within the margin, spherical, fixed by a narrow base, everywhere covered with sinuous plates or folds which give them a very wrinkled aspect; containing under a thick pericarp, composed of vertical filaments, a spherical deep red mass, consisting of innumerable minute spores, collected in small parcels, several of which make up the aggregate mass."—*Harvey.* Nemathecia thickly scattered over the surface of distinct plants, each covered by an obovate leafy process, attached by its narrow end, "and formed altogether of moniliform filaments, which I have not observed to be converted into spores."—*Harvey.* Tetraspores unknown.

This pretty species is by no means scarce on all our rocky shores, although it forms a rather small and unimportant fraction of the rejectamenta on the beach, owing to its close and secluded haunts, which are mostly under the shelving and projecting ledges of deep quiet rock-pools, not unfrequently protected by the additional covering of a thick tangled fringe of *Laminaria digitata* and *saccharina*, and in such places is seldom seen except by the prying eye of the enthusiastic botanist; its associates in such retreats being *Delesseria sanguinea*, *Phyllophora membranifolia*, and at times, *Griffithsia setacea*, along with multitudes of sponges, zoophytes, and such other animals and plants as prefer to live secluded from the eye of day.

It is a very pretty species when young, but the old fronds are soon covered by serpulæ, nullipores, and zoophytes, with which they are frequently entirely enveloped. Nemathecia appear to be abundant, tubercles to be rather uncommon, and tetraspores to be unknown.

EXPLANATION OF PLATE LXXVIII.

Fig. 1.—*Phyllophora rubens*, natural size.
2.—Fragment of frond, with nemathecium and cover folded back.
3.—Filaments from nemathecium.
4.—Fragment of frond with tubercle.
5.—Section of frond. All magnified.




PHYLLOPHORA rubens, GREV.

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# Plate LXXIX.

## PHYLLOPHORA MEMBRANIFOLIA.—*J. Ag.*

Gen. Char. —Frond flat, rigid, nerveless, uniformly cellular; cells minute, roundish angular. Fructification: "1. Tubercles (favellidia), scattered over the surface of the frond, and containing a mass of minute, roundish or angular spores; 2. Warts (nemathecia), seated on the frond, and composed of radiating moniliform filaments, whose lower articulations are at length converted into spores? 3. Tetraspores, on distinct plants, collected into sori, either towards the apex of the frond, or in proper leaflets." —*Harvey.* Name from φύλλον, "a leaf," and φορέω, "to bear."

Phyllophora *membranifolia.* — Stem elongated, filiform, cylindrical and branched; branches simple or once or twice divided, the terminal expanding into flat, broadly obcuneate or flabelliform segments, simple or once or twice dichotomously divided; tubercles ovate, on short stalks, arising from the sides of the stem and segments; nemathecia forming somewhat triangular patches in the middle of the segments.

Phyllophora *membranifolia.*—*J. Ag. Alg. Medit.* p. 93; *Endl.* 3rd Suppl. p. 38; *Harv. P. B.* plate 163; *Harv. Man.* p. 143; *Harv. Syn.* p. 117; *Atlas*, plate 1, fig. 4; *Harv. N. B. A.* part 2, p. 165.

Rhodymenia *membranifolia.*—*Harv.* in *Phyc. Br. Syst. List*, p. 12.

Chondrus *membranifolius.*—*Grev. Alg. Brit.* p. 131; *Hook. Br. Fl.* vol. ii. p. 302; *Harv.* in *Mack. Fl. Hib.* part 3, p. 202; *Wyatt, Alg. Danm.* No. 76; *Harv. Man.* 1st edit. p. 78.

Sphærococcus *membranifolius.*—*Ag. Syn.* p. 26; *Lyngb. Hyd. Dan.* p. 10, t. 3; *Ag. Sp. Alg.* vol. i. p. 240; *Ag. Syst.* p. 214; *Hook. Fl. Scot.* part 2, p. 102; *Grev. Fl. Edin.* p. 295; *Spreng. Syst. Veg.* vol. iv. p. 335.

Fucus *membranifolius.*—*Good. & Woodw.* in *Linn. Trans.* vol. iii. p. 120, t. 16, f. 1; *Lam. Diss.* t. 20, 21, f. 3; *Turn. Syn.* p. 25; *Turn. Hist.* t. 74; *Sm. E. Bot.* t. 1965; *Stack. Ner. Brit.* t. 20.

Fucus *fimbriatus.*—*Huds. Fl. Angl.* p. 574.

Hab.—On rocks, stones, old shells, &c., between tide-marks. Perennial. Winter. Common.

Geogr. Dist.—Atlantic shores of Europe and North America.

Description.—Root, a broad, thick, tubercular disc. Fronds tufted, many from the same root. Stems elongated, three to ten inches in length, and nearly half a line in thickness, branched from near the base; branches simple or once or twice irregularly divided, all the divisions filiform, cylindrical, expanding upwards into a thin, flat leaflet, broadly wedge-shaped or subflabelliform, simply or once or twice dichotomously

divided, with broad, rounded axils, and their apices broad and obtuse or emarginate from the formation of another dichotomy. Sometimes the stem and branches, especially upwards, are more or less fringed with small foliaceous processes, oblong or spathulate, simple or bifid, occasionally long, linear and strap-shaped. Structure uniformly cellular; central cells small, those at the surface very minute, all more or less coloured, more deeply towards the surface. Substance firm, rigid, and somewhat cartilaginous, not adhering to paper. Colour, a dark brownish purple, changing to greenish yellow and yellowish white in decay. Tubercles arising from the sides of the upper part of the stem as well as the branches and bases of the frondlets, obovate, on short stalks, composed of densely packed moniliform filaments, and containing a mass of minute roundish spores. Nemathecia, dark purple wart-like bodies, of a somewhat irregularly triangular form, occupying the centre of the leaflet, equally on both sides, but not permeating the leaflet, and formed of vertical moniliform filaments; on the same or on distinct plants from those bearing tubercles. Tetraspores we have not seen.

This handsome species is of equally common occurrence as the preceding, occupying similar localities. The nemathecia, as they are presumed to be from their peculiar organisation, are not unfrequent. The tubercles appear to be less common, and the tetraspores seem to be unknown.

It is readily distinguished from the preceding by its much darker, broader, more flabelliform leaflets, and elongated stems, stalked tubercles and curious nemathecia; from *Rhodymenia Palmetta* it may in general be known by its more regularly cylindrical stem, and the broader and more obtuse or truncate apices of the segments of the frond.

The true nature of the nemathecia is as yet but very imperfectly understood. They are composed, as above stated, of radiating moniliform filaments, very much resembling the structure of the crustaceous Algæ, and rest on the surface of the frond, with only the surface cells of which they can have any organic connexion, the central cells remaining unchanged between them; yet it is deserving of notice, that the nemathecium extends almost always uniformly and equally on both sides of the frond on which it is produced. No change of the articulations of its filaments either into spores or tetraspores, however, seems yet to have been observed, and its true nature still remains an interesting field for the investigation of the phycologist.

## EXPLANATION OF PLATE LXXIX.

Fig. 1. *Phyllophora membranifolia*, natural size.—2. Fragment of frond with tubercles.—3. Section of tubercle.—4. Filaments from its walls.—5. Frond with nemathecium.—6. Section of part of same. All magnified.

PHYLLOPHORA membranifolia, J. Ag.

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# Plate LXXX.

## PHYLLOPHORA BRODIÆI.—*J. Ag.*

Gen. Char.—Frond flat, rigid, nerveless, uniformly cellular; cells minute, roundish angular. Fructification: "1. Tubercles (favellidia), scattered over the surface of the frond, and containing a mass of minute roundish or angular spores; 2. Warts (nemathecia), seated on the frond, and composed of radiating moniliform filaments, whose lower articulations are at length converted into spores? 3. Tetraspores, on distinct plants, collected into sori, either towards the apex of the frond, or in proper leaflets." — *Harvey.* Name from φύλλον, "a leaf," and φορέω, "to bear."

Phyllophora *Brodiæi.* — Stem filiform, cylindrical, branched, the branches expanding into a thin membranaceous, obcuneate, simple or once divided frond, repeatedly proliferous from the extremity; tubercles (nemathecia) spherical, sessile at the apices of the leaflets.

Phyllophora *Brodiæi.* —*J. Ag. Alg. Medit.* p. 93; *Endl.* 3rd. Suppl. p. 38; *Harv. P. B.* plate 20; *Harv. Man.* p. 143; *Harv. Syn.* p. 117; *Atlas*, plate 45, fig. 207.

Coccotylus *Brodiæi.*—*Kütz. Phyc. Gen.* p. 412.

Chondrus *Brodiæi.* — *Grev. Alg. Brit.* p. 133; *Hook. Br. Fl.* vol. ii. p. 303; *Mack. Fl. Hib.* part 3, p. 202; *Harv. Man.* 1st edit. p. 78.

Sphærococcus *Brodiæi.*—*Ag. Syn.* p. 27; *Lyngb. Hyd. Dan.* p. 11, t. 3; *Ag. Sp. Alg.* vol. i. p. 239; *Ag. Syst.* p. 213; *Grev. Fl. Edin.* p. 295.

Delesseria *Brodiæi.*—*Turn. Hist.* t. 72; *E. Bot.* t. 1966; *Fl. Dan.* t. 1476.

Hab.—On rocks in the sea. Perennial? Winter and spring. Plentiful on the eastern coasts of Scotland. Mouth of the Bann, Co. Derry (*Mr. D. Moore*); Belfast Bay (*Mr. W. Thompson*).

Geogr. Dist.—Baltic Sea (*Mertens*); Denmark (*Lyngby*); German Ocean; Atlantic coast of France. Rare.

Description.—Root, a small spreading disc. Stems somewhat elongated, cylindrical and filiform, one and a-half to six inches in length, sparingly branched, the branches expanding upwards into thin, membranaceous frondlets, which are oblong or obcuneate, simple or once or twice forked, with rounded axils and rounded or bifid apices; generally repeatedly proliferous, with leaflets of similar form, and often have their apices fringed with minute leaf-like processes. Structure cellular; central cells small, hexagonal, those at the surface very minute, all more or less highly coloured. Substance rigid, not adhering to paper in drying. Colour,

a bright transparent brownish red, not changing in drying, passing into pale yellow white in decay. Tubercles (nemathecia) spherical, sessile on the apices of the leaflets, composed of radiating moniliform filaments, "the articulations of which are at length converted into tetraspores." No other fruit, we believe, has been observed.

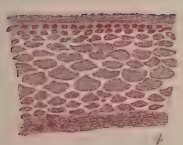
There is a very close resemblance between this species and *P. rubens*, both in form and colour, but the proliferous shoots of the present species arise from the apices of the leaflets or rarely from their margins, whereas in *P. rubens* they arise invariably from their discs. The situations of the tubercles also, which are generally produced abundantly in the present species, will afford an additional character. In *P. Brodiæi* the stems are more distinctly cylindrical, and the fronds somewhat less divided, and in almost all our specimens the apices are more or less fimbriated or laciniated. As in *P. rubens* also, the stems often produce long, linear, strap-shaped elongations.

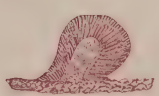
The tubercles or nemathecia are generally in abundance, but we have never been able to find perfect tetraspores or spores. In all the specimens we have dissected, the cells of the tubercle were filled with granular endochrome. In the centre these were large, pale, and lax; the remainder, forming the greater portion of the tubercle, were moniliform, small, densely packed, and filled with a deep, dark purple endochrome.

It was originally discovered by Mr. Brodie, of Brodie, at Lossiemouth, and to him the species has been dedicated by Agardh.

EXPLANATION OF PLATE LXXX.

Fig. 1.—*Phyllophora Brodiæi*, natural size.
2.—Section of nemathecium.
3.—Filaments from same.
4.—Section of frond. All magnified.





PHYLLOPHORA BRODIÆI. J. Ag.

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# Plate LXXXI.

## PHYLLOPHORA PALMETTOIDES.—*J. Ag.*

Gen. Char.—Frond flat, rigid, nerveless, uniformly cellular; cells minute, roundish angular. Fructification: "1. Tubercles (favellidia), scattered over the surface of the frond, and containing a mass of minute roundish or angular spores; 2. Warts (nemathecia), seated on the frond, and composed of radiating moniliform filaments, whose lower articulations are at length converted into spores; 3. Tetraspores, on distinct plants, collected into sori, either towards the apex of the frond, or in proper leaflets."—*Harvey.* Name from φύλλον, "a leaf," and φορέω, "to bear."

Phyllophora *Palmettoides.*—Stem cylindrical, filiform, short, simple or sparingly branched, gradually expanding into an obcuneate or obcordate flat frond, simple or only once forked, frequently proliferous from the apex; tetraspores collected into a roundish or transversely ovate sorus in the middle of the frond.

Phyllophora *Palmettoides.*—*J. Ag.* in litt. *Harv. P. B.* plate 310; *Harv. Man.* p. 144; *Harv. Syn.* p. 117; *Atlas*, plate 50, fig. 228.

Phyllophora *Brodiæi*, var. β *simplex.*—*Harv. P. B.* plate 20, figs. 2, 3, 4.

Chondrus *Brodiæi*, β *simplex.*— *Grev. Alg. Brit.* p. 133; *Hook. Br. Fl.* vol. ii. p. 303; *Harv. Man.* 1st edit. p. 78; *Wyatt, Alg. Danm.* No. 121.

Fucus *membranifolius*, var. *roseus.*—*Turn. Hist.* t. 72, f. m.

Hab.—On rocks, near low-water mark. Perennial. Winter and spring. Rare. Sidmouth and Torquay (*Mrs. Griffiths* and *Miss Cutler*); Plymouth and Whitsand Bay (*Rev. W. S. Hore*).—*P. B.*

Geogr. Dist.—As above. Mediterranean Sea.

Description.—Root, "a widely spreading disc, an inch or more in diameter." Fronds densely tufted or scattered, two to three inches in length. Stem a quarter to one inch in length and one-fifth of a line in thickness, gradually expanding into a flat oblong, obcuneate or obcordate frond, once or rarely twice divided, often entire or simply emarginate; the axils rather acute, the apices rounded. Structure somewhat loosely cellular; central cells larger than in the other species, those at the surface very small. Substance rather rigid, membranaceous, not adhering to paper in drying. Colour, a bright rosy red, brighter than in the preceding species, not changing in drying. Tetraspores collected into roundish or transversely oval sori in the middle of the frond.

This pretty little species was at one time considered a variety of the preceding, small specimens of which it closely resembles, the principal difference consisting in the brighter colour, smaller size, spare branching, but chiefly in the position of the tetraspores, the only kind of fructification that has been observed.

From that species also it differs in its geographical range of distribution, reaching its most northern limit in the south of England, whereas *P. Brodiæi* has only been found in the north of Scotland and Ireland.

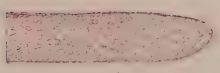
The species of this genus are all very closely related to each other, both in form and structure, and still more so in the obscurity in which their fructification seems still to be involved. In no species has the fructification been fully investigated. In one species nothing but spores have been observed; in another only tetraspores, and in another we hardly know which, and yet most of the species are common—very common. Surely a careful search would supply more accurate information regarding the fructification of these interesting plants.

EXPLANATION OF PLATE LXXXI.

Fig. 1.—*Phyllophora Palmettoides*, natural size.
2.—Segment with tetraspores.
3.—Tetraspores.
4.—Section of frond. All magnified.

1

3



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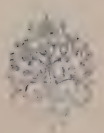

*Phyllophora palmettoides*, J. Ag.

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# Plate LXXXII.

## GYMNOGONGRUS GRIFFITHSIÆ.—*Mart.*

Gen. Char.—Frond between cartilaginous and horny, cylindrical, compressed or plane, composed of two strata of cells: those of the inner stratum roundish, angular, smaller outwards; those of the outer minute, forming vertical moniliform filaments, very densely packed. Fructification of two kinds, on distinct plants: 1. Favellidia, immersed in the substance of the frond, and more or less prominent; 2. Nemathecia, formed of radiating filaments, whose articulations are at length resolved into tetraspores. Name from *γυμνὸς*, "naked," and *γόγγρος*, a word applied by Theophrastus to a disease resembling a swelling to which trees are subject; the allusion is to the appearance of the fruit in these Algæ.

Gymnogongrus *Griffithsiæ*.—Frond cartilaginous, cylindrical, simple, or more or less dichotomously branched from near the base; ultimate ramuli short and fastigiate; warts lateral on the upper branchlets, at length surrounding the stem.

Gymnogongrus *Griffithsiæ*.—*Mart. Fl. Braz.* vol. i. p. 27; *Mont. Fl. Algier.* p. 119; *Harv. P. B.* plate 108; *Harv. Man.* p. 145; *Harv. Syn.* p. 118; *Atlas*, plate 50, fig. 228; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 316.

Tylocarpus *Griffithsiæ*.—*Kütz. Phyc. Gen.* p. 411.

Tylocarpus *tentaculatus* (?).—*Kütz.* l. c. t. 70, f. 2.

Chondrus *Griffithsiæ*.—*J. Ag. Alg. Medit.* p. 95; *Endl.* 3rd Suppl. p. 39.

Gigartina *Griffithsiæ*.—*Lamour. Ess.* p. 49; *Lyngb. Hyd. Dan.* p. 43, t. 11; *Grev. Alg. Brit.* p. 149; *Hook. Br. Fl.* vol. ii. p. 301; *Harv.* in *Mack. Fl. Hib.* part 3, p. 201; *Harv. Man.* 1st ed. p. 76; *Wyatt, Alg. Danm.* No. 28; *Mont. Fl. Canar.* p. 160.

Polyides *Griffithsiæ*.—*Gaill. Dict. Sc. Nat.* vol. liii. p. 365.

Sphærococcus *Griffithsiæ*.—*Ag. Sp. Alg.* vol. i. p. 316; *Ag. Syst.* p. 235; *Spreng. Syst. Veg.* vol. iv. p. 339.

Fucus *Griffithsiæ*.—*Turn. Hist.* t. 37; *E. Bot.* t. 1926.

Hab.—On rocks and stones near low-water mark. Perennial. Autumn and winter. Rather rare. Sidmouth and Torbay (*Mrs. Griffiths*); Exmouth (*Mrs. Gulson*); Bantry Bay (*Miss Hutchins*); Balbriggan (*Dr. Scott*); Mounts Bay (*Mr. Ralfs*); Strousa (*Lieut. Thomas* and *Dr. McBain*); Malahide (*Mr. M'Calla*).

Geogr. Dist.—Coasts of Europe; Canary Islands; Boston, North America (*Mr. Emerson*).

Description.—Root, a flattened conical disc. Fronds filiform, cylindrical throughout, and very much branched from a little below the

middle, one to three inches long, and less than one-quarter of a line thick at the base; branches dichotomous, short, and fastigiate upwards, erecto-patent, the axils mostly rounded, and rather wide, sometimes acute; the apices acute or occasionally somewhat compressed, "sometimes the upper branches, which have received an injury, produce dense bunches of branchlets without order, but these in their divisions soon assume the forked character of the species."—*Phyc. Brit.* Structure cellular, composed of two strata of cells, those in the centre oblong, forming imperfectly longitudinal filaments, from which arise other series at first inclined, at length vertical, moniliform and coloured, and very densely packed. Substance rather firm and horny. Colour, a dark brownish purple. Favellidia we have not seen in this species. Nemathecia formed externally on the branches, composed of vertically radiating filaments, whose articulations are at length resolved into cruciate tetraspores.

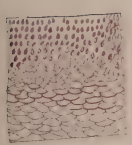
The only fructification which has been observed on this species in this country, so far as we are aware, is the wart-like nemathecia which arise irregularly on the surface of the branches, on which they appear more like small, wart-like parasites than as bodies organically connected with the frond. These tubercles entirely consist of densely packed moniliform filaments, gradually increasing in diameter upwards; these articulations are at length entirely converted into tetraspores, and when mature, form one of the most beautiful microscopic objects imaginable. The bright purple coloured granules, completely enveloped in their clear, glassy pericarps, attached to each other in long, slender strings, look like a collection of ruby necklaces, in settings of the purest crystal.

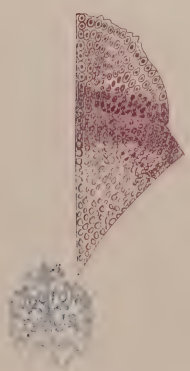
Imperfectly grown specimens have much the appearance of small specimens of *Ahnfeldtia plicata*, but the minute cells of the axis of the latter and much denser structure will be easily distinguished from the comparatively large cells and open structure of the former. The external appearance of the tubercles is also much the same in both, but in those of the present species the cells are greatly larger than in those of *Ahnfeldtia*, and their conversion into tetraspores much more perfect and apparent.

Its favourite habitat seems the somewhat sheltered sides of rocks near low-water mark, or the little open pools that are often found in such places, where it grows in single tufts, scattered here and there over the rocks, where its slender, wiry stems may be readily passed over, as they are objects of no apparent interest or beauty, especially in its more usual and irregularly branched state.

## EXPLANATION OF PLATE LXXXII.

Fig. 1.—*Gymnogongrus Griffithsiæ*, natural size.
2.—Branchlet with nemathecia.
3.—Semi-section of frond and nemathecium.
4.—Filament from nemathecium.
5.—Semi-section of frond. All magnified.





*GYMNOGRONGRUS Griffithsiæ, MART.*

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# Plate LXXXIII.

## GYMNOGONGRUS NORVEGICUS.—*Lamour.*

Gen. Char.—Frond between cartilaginous and horny, cylindrical, compressed or plane, composed of two strata of cells; those of the inner stratum roundish, angular, smaller outwards; those of the outer minute, forming vertical moniliform filaments, very densely packed. Fructification of two kinds, on distinct plants; 1. Favellidia, immersed in the substance of the frond, and more or less prominent; 2. Nemathecia, formed of radiating filaments, whose articulations are at length resolved into tetraspores. Name from γυμνὸς, "naked," and γόγγρος, a word applied by Theophrastus to a disease resembling a swelling to which trees are subject; the allusion is to the appearance of the fruit in these Algæ.

Gymnogongrus *Norvegicus.* — Frond linear, flat, dichotomously branched, apices rounded, obtuse; favellidia imbedded in the substance of the frond, very minute; nemathecia spherical, scattered over the surface of the frond.

Gymnogongrus *Norvegicus.—Lamour. Ess.* p. 39; *Lyngb. Hyd. Dan.* p. 16; *Grev. Alg. Brit.* p. 130; *Wyatt, Alg. Danm.* No. 120; *J. Ag. Alg. Medit.* p. 95; *Mont. Fl. Algier.* p. 117; *Endl.* 3rd Suppl. p. 39; *Harv.* in *Mack. Fl. Hib.* part 3, p. 202; *Harv. P. B.* plate 187; *Harv. Man.* p. 142; *Harv. Syn.* p. 115; *Atlas,* plate 44, fig. 203; *Harv. N. B. A.* part 2, p. 166; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 320.

Sphærococcus *Norvegicus.—Ag. Sp. Alg.* vol. i. p. 255; *Ag. Syst.* p. 218; *Spreng. Syst. Veg.* vol. iv. p. 335.

Oncotylus *Norvegicus.—Kütz. Phyc. Gen.* p. 411.

Fucus *Norvegicus.—Gunn. Fl. Norv.* vol. ii. p. 122, t. 3, f. 4; *Turn. Syn.* p. 222; *Turn. Hist.* t. 41; *E. Bot.* t. 1080; *Stack. Ner. Brit.* t. 18.

Fucus *Devoniensis.—Grev.* in *Wern. Trans.* vol. iii. p. 396.

Hab.—On stones and rocks near low water. Perennial. Not common, but found on all our coasts.

Geogr. Dist.—Coast of Norway; shores of France and Spain; Mediterranean Sea.

Description.—Root, a broad flattened disc. Fronds slightly tufted, two to three inches high, cylindrical at the base, and about half a line in thickness, gradually expanding into a flattened stem, from half an inch to an inch in length, and at length flat, four to five times dichotomously divided into narrow, linear, flat, entire, patent segments, half an inch to an inch long, and from one to three lines in breadth, the axils very broad and rounded, the apices broad and rounded or even emarginate, paler than the rest of the frond. Structure: central cells

rather large, roundish ovate, angular, smaller towards the circumference, where they are very minute, coloured, and form vertical, moniliform filaments. Substance, when fresh, cartilaginous; when dry, hard and horny. Colour, a deep dark, somewhat brownish red. Favellidia "minute, depressed, spherical, immersed in the substance of the frond, and scattered through its upper segments, each with a pale margin, and filled with very numerous spores:" these we have not seen, and they appear to be uncommon. Nemathecia rather large, hemispherical, sessile on both surfaces of the frond, and composed of radiating, moniliform filaments, gradually tapering to a point, and regularly dichotomous, their articulations at length converted into spores.

This species, although designated by the name *Norvegicus*, is said to be by no means common in Norway, and indeed Dr. Harvey suggests the probability of a doubt of the identity of the southern species with that so designated by Bishop Gunner, and if so, it would be better perhaps to designate the present plant by a name at least less inappropriate.

We have not met with it on the east coast, and have not seen specimens either from the west coast or from Ireland, but on the south and south-west coasts of England it seems to be by no means uncommon, and all our specimens are covered with nemathecia; these appear to be common even on the most dwarfy specimens.

Its flat fronds readily distinguish this from the last species, but from some of the varieties of *Chondrus crispus* it is not so readily distinguished at first sight, although the larger cells of the axis will readily be apparent when a thin section is placed under the microscope. Its linear fronds, rather thicker substance, and the pale reddish brown tips of the branches, will generally serve to separate the two species, even at sight.

EXPLANATION OF PLATE LXXXIII.

Fig. 1.—*Gymnogongrus Norvegicus*, natural size.
2.—Portion of frond with favellidia.
3.—Section of a favellidium.
4.—Spores from same.
5.—Portion of frond with nemathecia.
6.—Section of a nemathecium.
7.—Filaments from nemathecium. All magnified.

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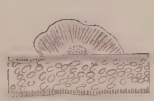

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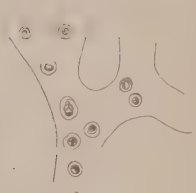

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*GYMNOCONGRUS Norregicus, LAMOUR.*

# Plate LXXXIV.

## AHNFELDTIA PLICATA.—*J. G. Ag.*

Gen. Char.—Frond cartilaginous or even horny, composed of two strata of cells; the inner forming very slender, densely-packed longitudinal filaments, those near the surface minute, forming vertical, very densely-packed moniliform filaments. Fructification "of two kinds, on distinct plants:" 1. "Favellidia, partially immersed in the substance of the frond;" 2. External tubercles or warts (nemathecia), composed of extremely fine radiating filaments.

Ahnfeldtia *plicata.*—Frond horny, filiform, cylindrical, very much branched irregularly between alternate and dichotomous; branches long, slender and wiry, patent or erecto-patent, often secund; nemathecia scattered over the surface of the branches.

Ahnfeldtia *plicata.*—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 311; *Harv. N. B. A.* part 2, p. 168.

Gymnogongrus *plicatus.*—*Kütz. Sp. Alg.* p. 789; *Harv. P. B.* plate 288; *Harv. Man.* p. 145; *Harv. Syn.* p. 119; *Atlas*, plate 46, fig. 211.

Gigartina *plicata.*—*Lamour. Ess.* p. 48; *Lyngb. Hyd. Dan.* p. 42; *Grev. Alg. Brit.* p. 150; *Hook. Br. Fl.* vol. ii. p. 301; *Wyatt, Alg. Danm.* No. 116; *Harv.* in *Mack. Fl. Hib.* part 3, p. 201; *Harv. Man.* 1st edit. p. 76.

Sphærococcus *plicatus.*—*Ag. Sp. Alg.* vol. i. p. 313; *Ag. Syst.* p. 234.

Tylocarpus *plicatus.*—*Kütz. Phyc. Gen.* p. 411.

Fucus *plicatus.*—*Huds. Fl. Angl.* vol. ii. p. 589; *Stack. Ner. Brit.* p. 23, t. 7; *Turn. Syn. Fuc.* p. 323; *Turn. Hist.* t. 180; *E. Bot.* t. 1089; *Fl. Dan.* t. 408.

Scytosiphon *hippuroides.*—*Lyngb. Hyd. Dan.* p. 63, t. 14.

Hab.—On rocks, stones, and old shells within tide-marks, and in deeper water. Perennial. Common.

Geogr. Dist.—Atlantic shores of Europe and America; New Holland (*R. Brown*); Southern Ocean, at Kerguelen's Land (*Dr. Hooker*).

Description.—Root, a minute horny disc. Fronds filiform, cylindrical, generally single, rarely tufted, excessively branched from the base, of equal diameter throughout, four to ten inches long or more, and about the thickness of a bristle; branches mostly dichotomous, frequently alternate, often secund, and occasionally fascicled, generally very patent, or more rarely erecto-patent, very long, slender and wiry, sometimes flexuous, the axils very patent, but not generally rounded.

Structure densely cellular or fibro-cellular, the axial cells larger, disposed in longitudinal series; from these arise others more slender, inclined, terminating in others very slender, vertical and moniliform. Substance cartilaginous, horny when dry. Colour, a deep dull purple, passing through greenish, dull orange, to white in bleaching. Favellidia unknown to us, and, so far as we know, have not been observed in this country. Nemathecia (?) are very common, but their metamorphosis into tetraspores is very imperfectly known, indeed we have never seen perfect fruit of any kind, on British specimens of this species.

This singularly wiry-looking plant is extremely abundant in this country, and appears to be equally abundant in many others, and we are informed in *Phyc. Brit.* that it is almost cosmopolitan in its habitat.

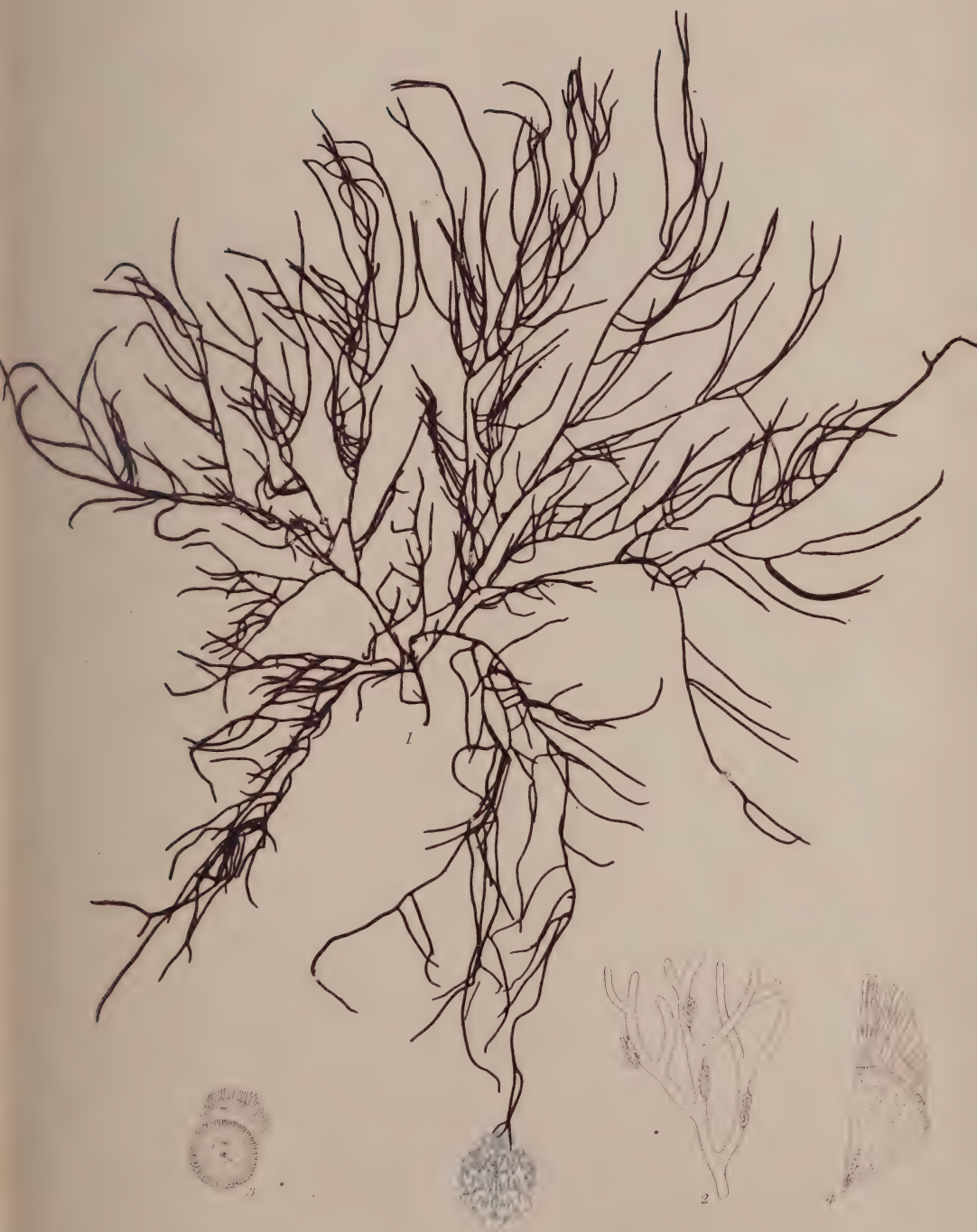
Although so common a plant, it seems to produce perfect fructification but seldom, at least in this country, and is consequently very imperfectly understood. Specimens without nemathecia, if they be really such, are very seldom met with, and they are generally abundant, but our knowledge of their ultimate form is still a desideratum.

Its favourite habitat is the bottoms of intratidal rock-pools, where it generally grows singly, more rarely tufted, generally very much branched, and often excessively and intricately entangled. The branches are generally single, but occasionally a number of them arise from the same point, forming a dense bundle, very much resembling those nest-looking branches so commonly observed on birch trees, which give a singular and fantastic character alike to both tree and Alga.

The species possesses no great beauty or attraction in its natural element either for its colour or form, but when partially bleached into a rich yellowish brown colour, it is by no means destitute of beauty, and in its native rock-pool its harsh wiry stems give variety to the vegetation, which constitutes at all times an important element in the beautiful and agreeable.

EXPLANATION OF PLATE LXXXIV.

Fig. 1.—*Ahnfeldtia plicata*, natural size.
2.—Branchlet with nemathecia (?).
3.—Section of a nemathecium.
4.—Segment of same. All magnified.




*GUNNELLIA plicata, J. G. Ag.*

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# Plate LXXXV.

## CYSTOCLONIUM PURPURASCENS.—*Kütz.*

Gen. Char.—Frond cartilaginous, filiform, composed of two strata: that forming the axis, of minute oblong cellules arranged in densely packed longitudinal series, around which are arranged numerous series of larger somewhat ovate polygonal cells, smaller to the circumference and coloured. Fructification of two kinds, on distinct plants: 1. Spherical tubercles, imbedded in the frond, containing minute spores attached to a central placenta; 2. Zonate tetraspores, immersed among the surface cells of the ramuli. Name from κύστις, "a vesicle or bladder," and κλωνίον, "a little branch," alluding to the immersed tubercles.

Cystoclonium *purpurascens.*—Frond much branched; branches irregularly alternate, shorter upwards; and, as well as the stem, everywhere clad with slender much divided branchlets.

Cystoclonium *purpurascens.*—*Kütz. Phyc. Gen.* p. 404, t. 58, f. 1; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 307; *Harv. N. B. A.* part 2, p. 170.

Hypnea *purpurascens.*—*Harv. P. B.* plate 116; *Harv. Man.* p. 131; *Harv. Syn.* p. 111; *Atlas*, plate 43, fig. 195.

Gracilaria *purpurascens.*—*Grev. Alg. Brit.* p. 122.

Plocaria *purpurascens.*—*Endl.* 3rd Suppl. p. 51.

Gigartina *purpurascens.*—*Lamour. Ess.* p. 136; *Lyngb. Hyd. Dan.* p. 46, t. 12; *Grev. Fl. Edin.* p. 290; *Hook. Br. Fl.* vol. ii. p. 299; *Harv.* in *Mack. Fl. Hib.* part 3, p. 200; *Harv. Man.* 1st edit. p. 73; *Wyatt, Alg. Danm.* No. 74.

Sphærococcus *purpurascens.*—*Ag. Sp. Alg.* vol. i. p. 318; *Ag. Syst.* p. 236; *Spreng. Syst. Veg.* vol. iv. p. 339; *Hook. Fl. Scot.* part 2, p. 134; *Fl. Dan.* t. 1835.

Fucus *purpurascens.*—*Huds. Fl. Angl.* p. 589; *Sm. E. Bot.* t. 1243; *Turn. Syn.* p. 357; *Turn. Hist. Fuc.* t. 9.

Fucus *tuberculatus.*—*Lightf. Fl. Scot.* p. 226.

Var. β. *cirrhosa.*—Branches irregular and much distorted, the apices lengthened into tendrils which clasp surrounding objects.

Cystoclonium *purpurascens*, β.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 308; *Harv. N. B. A.* part 2, p. 170.

Hypnea *purpurascens*, β.—*Harv. P. B.* descr. plate 116.

Fucus *tuberculatus*, β.—*Lightf. Fl. Scot.* p. 927.

Gigartina *purpurascens*, β *cirrhosa.*—*Lyngb. Hyd. Dan.* p. 46.

Hab.—On rocks, stones, old shells, &c., within tide-marks. Common. Annual. Summer.

Geogr. Dist.—Atlantic shores of Europe and North America.

Description.—Root, a mass of branching fibres. Fronds filiform, cylindrical, eight inches to two feet in length, one-half to one and a-half inch in thickness, repeatedly divided, gradually attenuated upwards, and slightly so to the base ; branches and stem almost from the base everywhere beset with much and irregularly divided ramuli, apices acute. Structure : axis about one-third the diameter, consisting of delicate, articulated longitudinal fibres, with joints three to four times as long as broad, rather loosely placed ; around are arranged numerous—six to ten—series of rather large, somewhat ovate, polygonal cells, smaller towards the circumference and coloured, those at the surface very minute. Substance cartilaginous, soft, and more or less perfectly adhering to paper. Colour, dull brownish purple, passing into yellowish brown in decay. Tubercles spherical or oval, forming regular swellings in the smaller ramuli, single, or two or three together, formed of the external cellular stratum of the ramulus, and containing a mass of minute ovate spores, produced by the metamorphosis of the cells of the axis (?). Tetraspores oblong, roundish, quadrizonate, produced from the coloured cells of the surface of the ramuli ; both kinds of fruit common and abundant.

This fine species is very common on all our shores, and often grows to a large size, producing its fruit abundantly. The variety $\beta$ is a singular one, should it prove to be only a variety, and proves the close relation between this and the true *Hypneæ*, from which it has been separated by Kützing. We have not met with this variety on the east coast, and have not seen it in fruit. In specimens from the Isle of Wight the whole plant is very slender and capillaceo-multifid, the branches but slightly attenuated, sometimes thickened upwards, very patent or divaricating, recurved, twisted and interlacing, the ultimate ramuli often spiriform. The structure is very much the same as in the normal form. In both the axis is always more or less occupied by minute cells. In $\beta$ the colour is often a rather pale rusty brown.

This is a very graceful plant when well grown, and although its colours are less gaudy than many of its neighbours, it generally forms a conspicuous object in almost every rock-pool, where it generally grows in single tufts, consisting of a number of individuals whose roots are all matted together.

## EXPLANATION OF PLATE LXXXV.

Fig. 1. *Cystoclonium purpurascens*, natural size.—2. Branchlet with tubercle.—3. Section of tubercle.—4. Spores.—5. Transverse section of stem.—6. Longitudinal section of stem.—7. Tetraspore. All magnified.

*CYSTOCLONIUM purpurascens. KUTZ.*

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# Plate LXXXVI.

## CALLOPHYLLIS LACINIATA.—*Kütz.*

Gen. Char.—Frond flat, without veins or midrib, cellular; cells minute, interspersed with large empty spaces or vesicles. Fructification of two kinds, on distinct plants: 1. Convex tubercles (coccidia), in marginal leaf-like processes, containing minute spores arranged in several groups; 2. Tetraspores, arranged in cloud-like linear patches near the margin. Name from καλὸς, "beautiful," and φύλλον, "a leaf."

Callophyllis *laciniata.* — Stem short, flattish, indistinct, suddenly expanding into a roundish flabelliform frond, much divided in an irregularly dichotomous manner; margins entire or fringed with minute ciliæ, containing the tubercles.

Callophyllis *laciniata.—Kütz. Phyc. Gen.* p. 401; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 299; *Harv. N. B. A.* part 2, p. 171.

Rhodymenia *laciniata.—Grev. Alg. Brit.* p. 86; *Hook. Br. Fl.* vol. ii. p. 289; *Wyatt, Alg. Danm.* No. 17; *Endl.* 3rd Suppl. p. 51; *Harv.* in *Mack. Fl. Hib.* part 3, p. 194; *Harv. Man.* p. 125; *Harv. Syn.* p. 104; *Atlas,* plate 39, fig. 179.

Delesseria *laciniata.—Grev. Fl. Edin.* p. 293; *Hook.* in *Fl. Lond.* new series, No. 198.

Delesseria *ciliaris.—Lamour. Ess.* p. 37.

Halymenia *ciliaris.—Gaill. Dict. Sc. Nat.* vol. liii. p. 360.

Sphærococcus *laciniatus.—Lyngb. Hyd. Dan.* p. 12, t. 4; *Ag. Sp. Alg.* vol. i. p. 297; *Ag. Syst.* p. 230; *Hook. Fl. Scot.* part 2, p. 103; *Spreng. Syst. Veg.* vol. iv. p. 334.

Fucus *laciniatus.—Huds. Fl. Angl.* p. 579; *Lightf. Fl. Scot.* p. 947; *Sm. E. Bot.* t. 1068; *Turn. Syn. Fuc.* p. 161; *Turn. Hist.* t. 69; *Esp. Ic. Fuc.* t. 140.

Fucus *crispatus.—Stack. Ner. Brit.* t. 15.

Fucus *miniatus.—Fl. Dan.* t. 769.

Fucus *crispus.—Esp. Ic. Fuc.* t. 18.

Hab.—On rocks, stones, old shells, and the stems of *Laminariæ,* within tide-mark, and in deep water. Biennial. January till August. Frequent on the British shores. Very common in Ireland and the Channel Islands.

Geogr. Dist.—Atlantic shores of Europe; Faroe Islands; eastern coasts of North America.

Description.—Root, a small spreading disc. Frond, from a short very indistinct stem, flat, roundish, three to ten inches long, much divided in a somewhat dichotomous or sub-flabelliform manner almost to the base,

into broad obcuneate segments, one to three inches broad, often again once or twice divided ; the segments broad upwards, the apices rounded and more or less deeply divided into linear laciniæ, obtuse when perfect, but often erose or somewhat acute ; the axils are generally broad and rounded, and the segments overlapping upwards, but frequently the axils are narrow, the segments linear, and scarcely or not at all overlapping ; many other varieties occur. Structure consisting of minute vesicles, all more or less coloured, among which are interspersed large empty ones, the minute cells forming the interstices or walls ; the surface ones being very minute. Tetraspores tripartite or cruciate, arranged in linear bands within the margin, immersed among the surface cells of the frond. Substance somewhat rigid, membranaceous, imperfectly adhering to paper. Colour, a bright permanent red or carmine, becoming rather darker in drying. Tubercles very convex, immersed in simple or compound marginal leaf-like laciniæ, with which the segments of the frond, especially towards the base, become fringed.

This beautiful species so much resembles *Nitophyllum* in many of its characters, that when less attention was paid to the structure than at present the two were often confounded together, but when the microscopical structure is taken into account, there cannot be the least difficulty in distinguishing the two.

The curious structure of the frond, which may be said to be vesicular rather than cellular, and the peculiar arrangement of the spores in separate groups, are its principal distinguishing characteristics. These vesicles are numerous, large, irregularly ovate, and appear to be empty.

The species is by no means rare on most of our shores, but seems most abundant on the west coasts. On the eastern side of the island we have never observed it growing even on the stems of *Laminariæ*, but it is not unfrequently cast on shore, and sometimes in considerable quantities.

From its bright colours and somewhat rigid substance it is much sought after by those who collect sea-weeds only for ornamental purposes.

Although subject to considerable variation in form, and in the division of its segments, yet there is something so peculiar in the colour and structure as well as outline of the frond which prevents it from being readily confounded with any other.

EXPLANATION OF PLATE LXXXVI.

Fig. 1.—*Callophyllis laciniata*, natural size.
2.—Portion of frond with tubercle.
3.—Section of frond and spores.
4.—Portion of frond with tetraspores.
5.—Tetraspores from same. All magnified.

*CALLOPHYLLIS laciniata. KÜTZ.*

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# Plate LXXXVII.

## KALLYMENIA RENIFORMIS.—*J. Ag.*

Gen. Char.—Frond flat, membranaceous, without veins or midrib, consisting of three strata, the inner composed of continuous interlacing filaments, succeeded by a stratum of rather large coloured cells, which are covered by a thin stratum of radiating moniliform cellules at the surface. Fructification of two kinds, on distinct plants : 1. Favellidia, slightly convex, containing groups of minute spores ; 2. Tripartite tetraspores, scattered under the surface. Name from καλὸς, "beautiful," and ὑμην, "a membrane."

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Kallymenia *reniformis.—J. Ag. Alg. Medit.* p. 99 ; *Endl.* 3rd Suppl. p. 40 (excl. syn. *Post.* and *Rupp.*) ; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 286 ; *Harv. P. B.* plate 13; *Harv. Man.* p. 149 ; *Harv. Syn.* p. 122 ; *Atlas*, plate 47, fig. 213.

Iridæa *reniformis.—Bory, Dict. Class.* vol. ix. p. 16 ; *Grev. Alg. Brit.* p. 160.

Halymenia *reniformis.—Ag. Sp.* vol. i. p. 201 ; *Syst.* p. 241 ; *Spreng. Syst. Veg.* vol. iv. p. 333 ; *Gaill. Dict. Sc. Nat.* vol. liii. p. 361.

Rhodymenia *reniformis.—Hook. Br. Fl.* vol. ii. p. 292 ; *Wyatt, Alg. Danm.* No. 19 ; *Harv.* in *Mack. Fl. Hib.* part 3, p. 195 ; *Harv. Man.* 1st ed. p. 64.

Euhymenia *reniformis.—Kütz. Phyc. Gen.* p. 400.

Sarcophyllis *lobata?—Kütz.* l. c. p. 401, t. 76, f. 3.

Fucus *reniformis.—Turn. Hist. Fuc.* t. 113 ; *E. Bot.* 2116.

Hab.—In shady rock-pools at extreme low-water mark. Not uncommon. Oftener washed on shore from deep water. Spring, summer and autumn. Perennial.

Geogr. Dist.—Shores of the British Islands ; Atlantic shores of France ; Mediterranean Sea (*Ag.*).

Description.—Root, a small flat disc. Stem very short, scarcely cylindrical, about a quarter of an inch long, suddenly expanding into a roundish, reniform, simple or slightly divided frond ; when old, frequently proliferous at the margin with smaller fronds similar to the primary one. The primary frond varies very much in size as well as in shape, and is from an inch to a foot or upwards in diameter, the margin generally more or less waved or crisped. Structure composed of a central stratum of slender, articulated, interlacing and anastomosing filaments, occupying nearly one-half the thickness of the frond, the remainder being composed of cells, the inner of which are rather large,

ovate-oblong, and coloured; those next the surface very minute, and arranged in vertical filamentous series. Substance membranaceous, somewhat soft and fleshy, adhering but rather imperfectly to the paper. Colour, a deep blood-red, passing into yellow in decay. Tubercles (favellidia) slightly elevated, immersed in the substance of the frond, and containing groups of minute ovate spores. Tetraspores extremely minute, triparted, scattered among the radiating cells of the surface.

This beautiful species is not unfrequent on all the Irish shores, mostly washed on shore from deep water. On the British coasts it is much less common, although it extends as far north as the Orkney Islands.

When much torn by the waves it frequently becomes very much divided in the margin, occasionally almost to the base, but otherwise the frond is nearly entire, and presents more or less of a roundish or reniform outline.

EXPLANATION OF PLATE LXXXVII.

Fig. 1.—*Kallymenia reniformis*, natural size.
2.—Portion of frond with favellidia.
3.—Section of same.
4.—Spores.
5.—Portion of frond with tetraspores.
6.—Tetraspores. All magnified.

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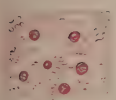

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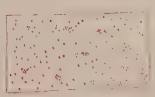

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*KALYMENIA reniformis, J. Ag.*

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# Plate LXXXVIII.

## GIGARTINA PISTILLATA.—*Lamour.*

Gen. Char.—Frond cartilaginous, filiform, compressed or flat, consisting of two strata; inner of longitudinal, interlacing and anastomosing filaments; the outer of vertical, dichotomous, articulated filaments, loosely imbedded in a firm jelly, the apical joints of which are minute, moniliform, coloured, not branching, parallel, and firmly cohering. Fructification of two kinds, on distinct plants: 1. "External tubercles, containing on a central placenta dense clusters of spores (favellidia), held together by a network of fibres" (*Harv.*); 2. Tetraspores, "scattered among the filaments of the periphery," or collected into immersed sori.

Gigartina *pistillata.*—Frond compressed, stalked, somewhat dichotomously branched in a sub-flabelliform manner; branches very patent, naked or pinnated with short patent ramuli; tubercles solitary or in pairs; tetraspores in sori in the ramuli.

Gigartina *pistillata.*—*Lamour. Ess.* p. 49; *Grev. Alg. Brit.* p. 146; *Hook. Br. Fl.* vol. ii. p. 300; *Endl.* 3rd Suppl. p. 41; *Kütz. Phyc. Gen.* p. 402, t. 70, f. 1; *Mont. Fl. Alg.* p. 99; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 264; *Harv. P. B.* plate 232; *Harv. Man.* p. 140; *Harv. Syn.* p. 113; *Atlas*, plate 43, fig. 197.

Sphærococcus *gigartinus.*—*Ag. Sp. Alg.* vol. i. p. 274; *Ag. Syst.* p. 224.

Fucus *pistillatus.*—*Gmel. Fuc.* p. 159, t. 12, f. 1; *Lam. Diss.* p. 51, t. 27.

Fucus *gigartinus.*—*Linn. Syst. Nat.* vol. ii. p. 719; *Good. & Woodw.* in *Linn. Trans.* vol. iii. p. 183, t. 17, figs. 3, 4; *E. Bot.* t. 908; *With.* vol. iv. p. 111; *Turn. Syn.* vol. ii. p. 280; *Turn. Hist.* t. 28.

Fucus *Œderi.*—*Esper*, t. 135.

Ceramium *gigartinum.*—*Roth, Cat.* vol. iii. p. 109.

Hab.—On rocks near low-water mark. Perennial. Winter. Very rare. Coast of Cornwall, in several places (*Hon. Dr. Wenman*, before 1800); St. Ives (*Stackhouse*); Penzance (*Brodie*); Padstow (*Miss Hill*); Mouth of the Padstow River on rocks (*Mrs. Griffiths*); Mounts Bay (*Dr. McCulloch*); Whitsand Bay (*Dr. Jacob*, 1829, *Gilbert Saunders*, 1848); Jersey (*Miss Turner*).

Geogr. Dist.—Atlantic shores of France and Spain; Mediterranean Sea.

Description.—Root, a flat disc. Fronds much tufted, two to five inches high. Stem about one-half the length of the frond, cylindrical or nearly so at the base, but gradually becoming more compressed upwards to the forking, where it generally reaches its greatest compression, the branches becoming gradually rounder upwards, the ultimate ramuli being again nearly cylindrical. Fronds three to five times dichotomous;

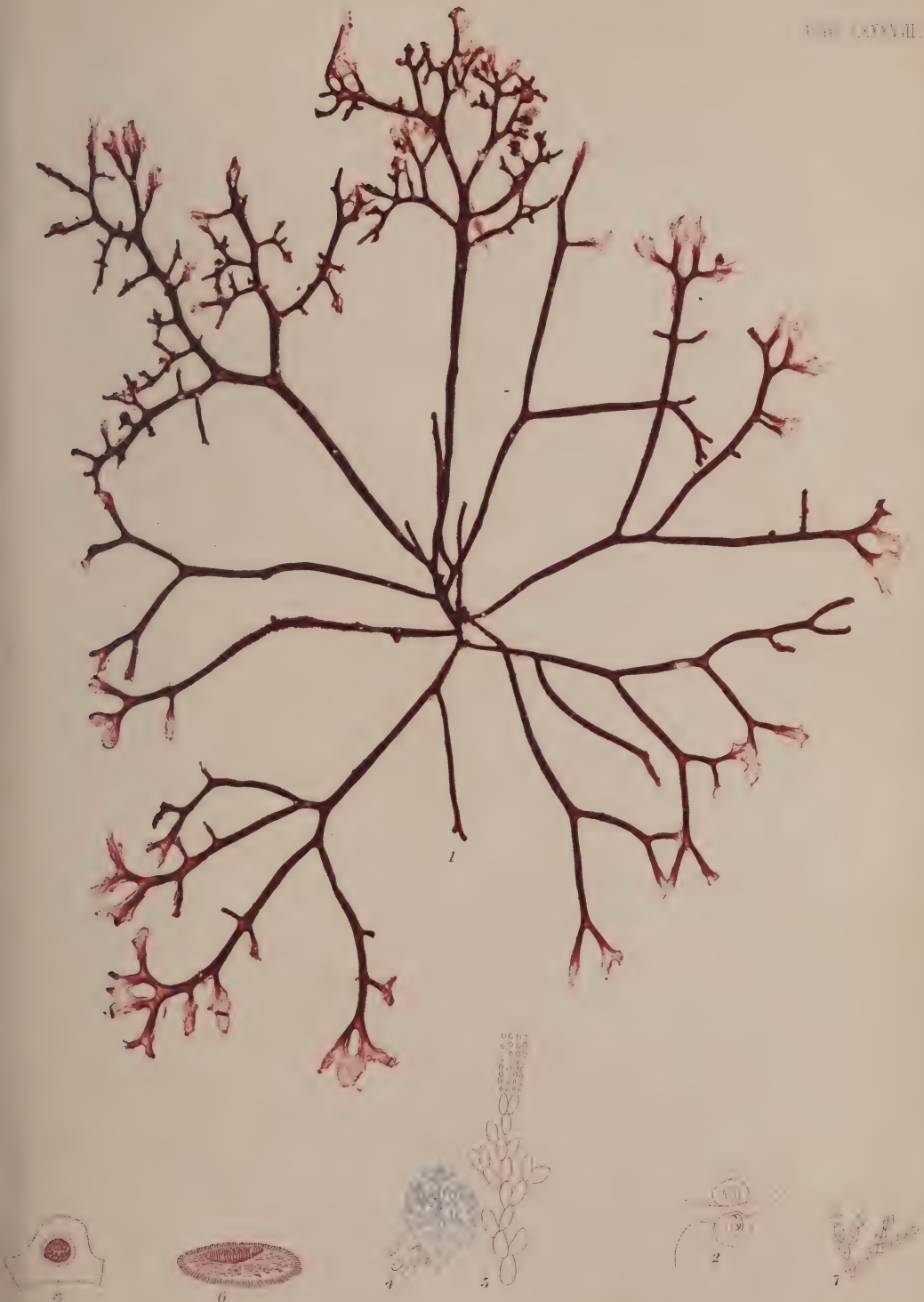
branches very patent or divaricate, forming a roundish sub-flabelliform frond. In plants producing tubercles the branches and ramuli are more or less closely pinnated with short cylindrical or slightly clavate horizontal branchlets, simple, toothed, bifid or even shortly dichotomous ; with these the branch is sometimes closely and regularly pectinated, at other times only one or two are scattered here and there, or grouped together on one side. Barren or young fronds are generally compressed to the apices, and not unfrequently have some of these flattened and spathulate. Substance cartilaginous, firm and rigid, not at all adhering to paper. Structure : central portion consisting of longitudinal, interlacing and anastomosing jointed filaments, with short joints occupying the greater portion of the frond ; these are succeeded by rather large cells, arranged in vertical dichotomous series, the ultimate dichotomies moniliform, of minute coloured cells, forming the surface. Colour, a dark dull brownish red. Tubercles on the pinnæ terminal, or near the apex, occasionally sessile on the ramuli, and apparently formed by the metamorphosis of the entire pinna. Tetraspores in dense sori immersed in the branches, and consisting of chains of tetraspores in dichotomous vertical series.

This singular plant is one of our southern rarities, having reached its northern limit in the south of England, and even there it is by no means common. Young plants have sometimes a slight resemblance to *Chondrus crispus*, but are more rigid and woody. To *G. mamillosa* in the young state it has also considerable resemblance, but the segments are more patent and rigid. There is scarcely any other British species with which it can be confounded.

Its very rigid woody habit must render it a striking object in its native pools, where, although less brilliant in colouring, and less delicate in form than some of its more attractive neighbours, its stiff shrub-like fronds will serve to give variety to the vegetation, and relieve, by its very rigidity, the uniform softness produced by the abundance of more delicate forms.

EXPLANATION OF PLATE LXXXVIII.

Fig. 1.—*Gigartina pistillata*, natural size.
2.—Branchlet with tubercles.
3.—Section of tubercle.
4.—Spores.
5.—Vertical filament.
6.—Section of sorus.
7.—Tetraspores from same. All magnified.




*GIGARTINA pistillata, LAMOUR.*

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# Plate LXXXIX.

## GIGARTINA ACICULARIS.—*Lamour.*

Gen. Char.—Frond cartilaginous, filiform, compressed or flat, consisting of two strata; inner of longitudinal, interlacing and anastomosing filaments; the outer of vertical, dichotomous, articulated filaments, loosely imbedded in a firm jelly, the apical joints of which are minute, moniliform, coloured, not branching, parallel and firmly cohering. Fructification of two kinds, on distinct plants: 1. "External tubercles, containing on a central placenta dense clusters of spores (favellidia), held together by a network of fibres" (*Harv.*); 2. Tetraspores, "scattered among the filaments of the periphery," or collected into immersed sori.

Gigartina *acicularis.*—Fronds cylindrical, irregularly pinnated or subdichotomous, sparingly branched from near the base; branches very patent, occasionally secund, often curved.

Gigartina *acicularis.*—*Lamour. Ess.* p. 49; *Gaill. Dict. Sc. Nat.* vol. liii. p. 365; *Duby, Bot. Gall.* p. 953; *Grev. Alg. Brit.* p. 147, t. 16; *Hook. Br. Fl.* vol. ii. p. 300; *Wyatt, Alg. Danm.* No. 26; *J. Ag. Alg. Medit.* p. 105; *Mont. Fl. Alg.* p. 100; *Kütz. Phyc. Gen.* p. 403; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 263; *Harv. P. B.* plate 104; *Harv. Man.* p. 140; *Harv. Syn.* p. 113; *Atlas*, plate 50, fig. 201.

Sphærococcus *acicularis.*—*Ag. Sp. Alg.* vol. i. p. 322; *Ag. Syst.* p. 237.

Fucus *acicularis.*—*Wulf. Crypt. Aquat.* No. 50; *Turn. Hist.* t. 126; *Sm. Eng. Bot.* t. 2190.

Hab.—On submarine rocks near low-water mark. Annual. Winter. Rare. Cornwall (*W. Rashleigh*); Ilfracombe, Lupton Cove, and Torquay (*Mrs. Griffiths*); Sidmouth (*Miss Cutler*); Jersey (*Misses White* and *Turner*); Belfast Bay (*Mr. Templeton*); Valentia, abundant; Kilkee, very rare (*Dr. Harvey*).

Geogr. Dist.—Abundant on the shores of France and Spain; Mediterranean Sea; Indian Ocean (*Wight*); Tasmania (*Dr. Hooker*).

Description.—Root, a minute disc, with few branching fibres. Fronds much tufted, two to four inches high, and half a line to a line in diameter, much branched in a somewhat irregularly bipinnated manner, mostly scattered, sometimes fascicled, occasionally dichotomous, very patent, sometimes recurved, with gradually acuminated points, and more or less attenuated to the base; sometimes the ramuli are few, short and spine-like, set on at right angles to the stem; at other times they are considerably elongated and again subdivided in a similar manner; sometimes the main stem or principal branch is undivided to the summit, and then furnished with a dense fascicle of simple or compound branches, in a regular

flabelliform manner; frequently the branches are more or less curved, and the ramuli often secund. Structure: axis composed of longitudinal, articulated, anastomosing filaments, occupying about one-half the diameter of the frond, then becoming vertical, dichotomous, and at length simple, moniliform, and highly coloured, parallel and densely-packed, forming the surface. Substance externally rather firm, internally rather soft and flaccid; when young adhering more or less perfectly to paper. Colour, a dull brownish red, rather permanent. Tubercles lateral, near the apices of the ramuli, mostly solitary, turning the apex of the branch in the opposite direction. Tetraspores we have not seen.

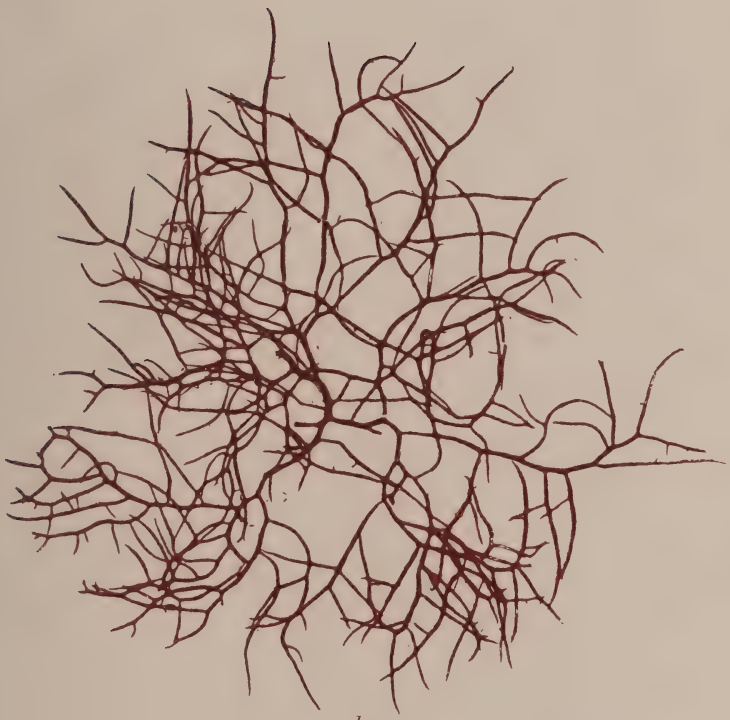
The present pretty little species was at one period considered among the rarest of British Algæ; and, although recent exploration has detected numerous new habitats, and thus considerably extended its range of distribution, it is still considered a scarce plant, and specimens in good condition are by no means common in collections. Tetraspores appear to be uncommon, as we have not seen them, but tubercles are not unfrequent; and we have been favoured with fine specimens in that state by Miss Hodgson of Ulverstone.

It may be distinguished from the last by its cylindrical stems and branches, more straggling and more acute at the apices, frequently with scarcely any distinct stem, less rigid in substance and rather brighter in the colour.

The external coating of these plants, especially of *G. pistillata*, is very elastic, and when a transverse section of the frond is made and put in water, the ring formed by the external coating of cells splits and rolls backwards, forming a ring in its recurved position; the vertical moniliform filaments that formerly lined its interior, now radiating from every part of its surface, like the rays of light from a star, present a very beautiful and curious appearance. The dermal coatings of several other Algæ are possessed of a similar property, but in some of them the action is inwards not outwards; and in some there is a strange tendency to twist round in a spiral, sometimes peculiarly annoying in microscopical examination, although very interesting to the curious, who are only in search of striking objects for the microscope, and still more so to the philosophical inquirer, to whom no form or development of animal or vegetable life can present itself without a lesson of instruction.

EXPLANATION OF PLATE LXXXIX.

Fig. 1.—*Gigartina acicularis*, natural size.
2.—Branchlet with tubercles.
3.—Section of tubercle.
4.—Spores.
5.—Vertical filaments of stem. All magnified.



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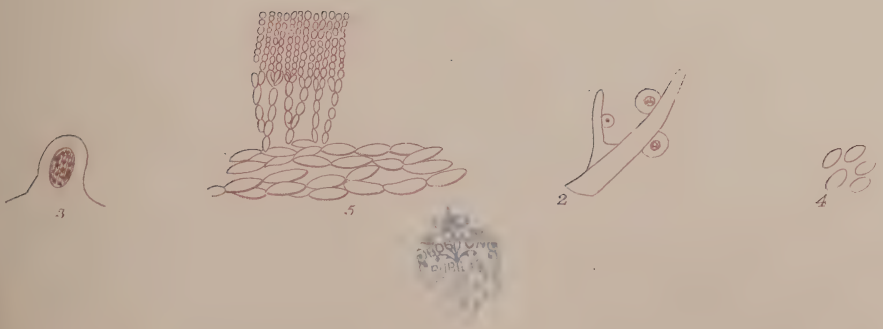

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*Gigartina acicularis Lamour.*

## GIGARTINA TEEDII.—*Lamour.*

Gen. Char.—Frond cartilaginous, filiform, compressed or flat, consisting of two strata; inner of longitudinal, interlacing and anastomosing filaments; the outer of vertical, dichotomous, articulated filaments, loosely imbedded in a firm jelly, the apical joints of which are minute, moniliform, coloured, not branching, parallel and firmly cohering. Fructification of two kinds, on distinct plants: 1. "External tubercles, containing on a central placenta dense clusters of spores (favellidia), held together by a network of fibres" (*Harv.*); 2. Tetraspores, "scattered among the filaments of the periphery," or collected into immersed sori.

Gigartina *Teedii.*—Frond cartilagineo-membranaceous, flat, linear, closely and repeatedly pinnated; pinnæ and pinnules very irregular, opposite or alternate, distichous and horizontal; ultimate ramuli short and spine-like.

Gigartina *Teedii.*—*Lamour. Ess.* p. 49, t. 4, f. 11; *Hook. Br. Fl.* vol. ii. p. 301; *Wyatt, Alg. Danm.* No. 27; *Endl.* 3rd Suppl. p. 42; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 266; *Harv. P. B.* plate 266; *Harv. Man.* p. 140; *Harv. Syn.* p. 114; *Atlas*, plate 44, fig. 201.

Chondracanthus *Teedii.*—*Kütz. Phyc.* p. 399.

Rhodymenia *Teedii.*—*Grev. Alg. Brit.* p. 96.

Sphærococcus *Teedii.*—*Ag. Sp. Alg.* vol. i. p. 277; *Ag. Syst. Alg.* p. 225; *Grev. Crypt. Fl.* t. 356.

Fucus *Teedii.*—*Roth, Cat. Bot.* vol. iii. p. 108, t. 4; *Turn. Hist. Fuc.* t. 208.

Hab.—On rocks at the extreme of low-water mark. Perennial. Very rare. Elberry Cove, Torbay (*Mrs. Griffiths*, 1811).

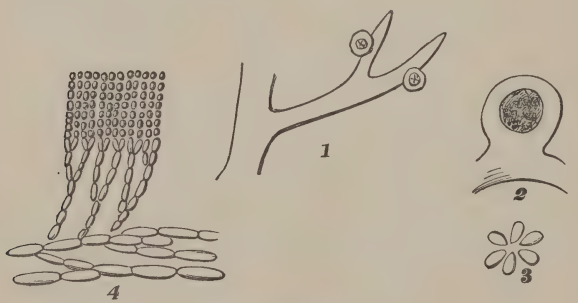
Geogr. Dist.—Atlantic coasts of France, Spain, and Portugal; Mediterranean Sea, abundant.

Description.—Root, a small conical flattened disc. Fronds much tufted, two to five or six inches long, with a roundish or ovate outline; the principal stem one to one and a-half, or even three to four lines in breadth, three to four times pinnated; pinnæ and pinnulæ distichous, irregularly alternate or opposite, pinnulæ very close and patent, mostly horizontal, all the divisions more or less set with lateral spine-like, simple or compound ramuli, mostly acute but occasionally obovate or spathulate, all of very unequal length, from that of a minute spine, not more than half a line long, to that of a branch two to three inches, frequently forked at the extremities, attenuated at the base, and the apices much acuminated to an obtuse point. Structure composed of two kinds of jointed filaments, those in the centre composing

about one-half the diameter, longitudinal, anastomosing and interlacing, formed of cylindrical cells, from which arises a second series, vertical, dichotomous; their upper dichotomies elongated, close packed, their joints moniliform, forming the periphery. Substance soft and rather flaccid; when dry, rather hard, rigid. Colour, rather bright brownish red, yellowish green in decay. Tubercles we have not seen; they are described as spherical, scattered over the sides of the ramuli, sessile or partly immersed.

This fine species is extremely rare in this country; we have seen no specimens except those collected by the late Mrs. Griffiths, and these are barren. From *G. acicularis* it may be readily distinguished by its flattened stems, and much more numerous branches; from *G. pistillata*, by being branched from the very base, where it is scarcely cylindrical, and the spine-like branches on the ramuli being all more or less compressed or flat.

On the Atlantic shores of the continent, and on those of the Mediterranean, this species is said to be not uncommon, producing fruit abundantly.




GIGARTINA TEEDII.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet with tubercles.
2.—Section of a tubercle.
3.—Spores from same.
4.—Longitudinal and vertical filaments. All magnified.

# Plate XC.

## GIGARTINA MAMILLOSA.—*J. Ag.*

Gen. Char.—Frond cartilaginous, filiform, compressed or flat, consisting of two strata; inner of longitudinal, interlacing and anastomosing filaments; the outer of vertical, dichotomous, articulated filaments, loosely imbedded in a firm jelly, the apical joints of which are minute, moniliform, coloured, not branching, parallel and firmly cohering. Fructification of two kinds, on distinct plants: 1. "External tubercles, containing on a central placenta dense clusters of spores (favellidia), held together by a network of fibres" (*Harv.*); 2. Tetraspores "scattered among the filaments of the periphery," or collected into immersed sori.

Gigartina *mamillosa.*—Frond subcartilaginous, flat, channeled, at least when producing tubercles, regularly dichotomous, and more or less obcuneate; tubercles shortly stalked, scattered over the surface.

Gigartina *mamillosa.*—*J. Ag. Alg. Medit.* p. 104; *Endl.* 3rd Suppl. p. 42; *Harv. P. B.* plate 199; *Harv. Man.* p. 141; *Harv. Syn.* p. 114; *Atlas*, plate 42, fig. 194; *Harv. N. B. A.* part 2, p. 175; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 273.

Mastocarpus *mamillosus.*—*Kütz. Phyc. Gen.* p. 398.

Chondrus *mamillosus.*—*Grev. Alg. Brit.* p. 127; *Hook. Br. Fl.* vol. ii. p. 302; *Wyatt, Alg. Danm.* No. 117; *Harv.* in *Mack. Fl. Hib.* part 3, p. 201; *Harv. Man.* 1st edit. p. 77.

Sphærococcus *mamillosus.*—*Ag. Syn.* p. 29; *Lyngb. Hyd. Dan.* p. 14, t. 5; *Ag. Sp. Alg.* vol. i. p. 260; *Ag. Syst.* p. 220; *Hook. Fl. Scot.* part 2, p. 102; *Grev. Fl. Edin.* p. 295; *Spreng. Syst. Veg.* vol. iv. p. 336.

Fucus *mamillosus.*—*Good. & Woodw.* in *Linn. Trans.* vol. iii. p. 174; *Turn. Syn.* p. 237; *Turn. Hist.* t. 218; *E. Bot.* t. 1054.

Fucus *polymorphus.*—*Lam. Diss.* (4th series) p. 3, t. 17, f. 37; t. 18, f. 38.

Fucus *echinatus.*—*Stack. Ner. Brit.* p. 65, t. 12.

Fucus *caniculatus*, β.—*Huds. Fl. Angl.* p. 583.

Fucus *ceranoides*, var.—*Lightf. Fl. Scot.* p. 916; *Gmel. Hist.* p. 115; *With. Arr.* vol. iv. p. 99.

Fucus *alveolatus.*—*Esper, Ic.* p. 139, t. 70.

Hab.—On stones and rocks near low-water mark. Perennial. Winter. Common.

Geogr. Dist.—Atlantic shores of Europe and North America.

Description.—Root, a broad flat disc. Fronds densely tufted, three to six or eight inches high. Stem cylindrical at the base, becoming gradually flattened upwards for one or two inches, then dividing in

a more or less regular dichotomous manner three or four times into obcuneate or sub-flabelliform fronds, the dichotomies rather distant; axils wide, rounded; branches erect or erecto-patent, obcuneate or linear obcuneate, rarely acute, generally channeled by the curving upwards of the edges of the frond, especially when tubercles are confined to one side, very variable in breadth; the more linear forms from two to six lines, the more obcuneate varieties nearly an inch, the apices emarginate or forked, with acute segments. Sometimes the segments are lanceolate or spathulate, entire or bifid, with obtuse or spathulate segments. Tubercles more or less thickly scattered over the surface of the frond, sometimes confined to one side, which is then generally channeled, sometimes partly on one side and partly on the other, and occasionally both sides are equally covered; but generally, when they are abundant on one side of the frond they are wanting on that part of the opposite side. They at first appear in the form of minute papillæ, then become elongated and cylindrical, and at length spherical tubercles are formed near the extremities, and are extremely common. Tetraspores we have not seen. Structure: the central portion composed of longitudinal anastomosing jointed filaments, consisting of cylindrical cells, from which arise vertical dichotomous filaments formed of obovate cells; their apices simple, of moniliform, deeply coloured cells, closely packed, forming the surface stratum. Substance very tough and rigid, not at all adhering to paper. Colour, a dark reddish brown, almost black towards the base, paler upwards and in the younger part of the frond.

This is one of our most common plants, being found on all our coasts, in many places in greater abundance even than *Chondrus crispus*, and generally with tubercles. In some places we have seen it on the rocks near low-water mark, with a close carpet, prettily dotted with the pale yellowish green fronds of *Chondrus crispus*. Under such circumstances there is no difficulty in distinguishing the species; such however is not always the case, for it not unfrequently happens that varieties occur whose identity is so difficult to decide that an appeal to the microscope alone can settle the question, and that even with difficulty.

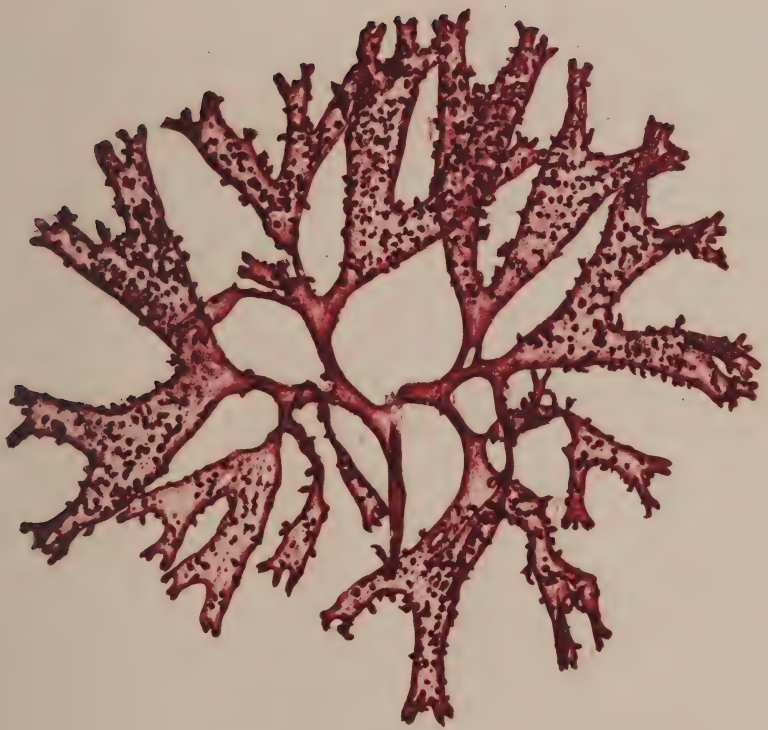
It is a curious circumstance, if found invariably correct, that tetraspores are so rare in this species, and so common on *Chondrus crispus*, while on the other hand tubercles are so rare on the latter, and tetraspores so common.

The best *primâ facie* character perhaps is the channeled frond, but we have seen fronds of this with the segments quite plane. Indeed, when there are tubercles equally on both sides of the segments they are generally plane, but if fruited only on one side they are almost invariably channeled, that is, have the margins incurved upon the fruit. Sometimes

we have seen the stem, or the stem and lower branches alone, channeled, the upper segments being plane, whilst in specimens densely fruited, on the other hand, we have seen the stem plane and the segments with the tubercles much incurved.

EXPLANATION OF PLATE XC.

Fig. 1.—*Gigartina mamillosa*, natural size.
2.—Portion of a fertile frond.
3.—Vertical section of a tubercle.
4.—Spores from same.
5.—Vertical semisection of frond. All magnified.



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*Gigartina mamillosa. J. Ag.*

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# Plate XCI.

## CHONDRUS CRISPUS.—*Lyngb.*

Gen. Char.—Frond cartilaginous, nerveless, flat, or in the narrow forms compressed. Fructification: 1. Nemathecia, external, filled with minute spores; 2. Favellidia, partly immersed in the frond; 3. Tetraspores, collected in sori immersed in the frond. Chondrus (*Stack.*) from χόνδρος, "cartilage."

Chondrus *crispus*.—Frond dichotomous, flabelliform; segments broad, flat, and obcuneate or narrow, linear and compressed; the apices obtuse or emarginate; axils rounded.

Chondrus *crispus*.—*Lyngb. Hyd. Dan.* p. 15, t. 5 A, B; *Grev. Alg. Brit.* p. 129, t. 15; *Hook. Br. Fl.* vol. ii. p. 302; *Wyatt, Alg. Danm.* No. 118 and 119; *Endl.* 3rd Suppl. p. 39; *Kütz. Phyc. Gen.* p. 398, t. 73, fig. 3; *Harv.* in *Mack. Fl. Hib.* part 3, p. 201; *Harv. P. B.* plate 63; *Harv. Man.* p. 141; *Harv. Syn.* p. 115; *Atlas*, plate 44, fig. 202; *Harv. N. B. A.* part 2, p. 181; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 246.

Chondrus *polymorphus*.—*Lamour. Ess.* p. 39.

Chondrus *incurvatus*.—*Kütz. Phyc. Gen.* p. 399, t. 73, fig. 2.

Chondrus *celticus*.—*Kütz.* l. c.

Sphærococcus *crispus*.—*Ag. Sp. Alg.* vol. i. p. 256; *Syst.* p. 219; *Grev. Fl. Edin.* p. 294; *Spreng. Syst. Veg.* vol. iv. p. 335.

Fucus *crispus*.—*Linn. Mant.* p. 134; *Syst. Nat.* vol. ii. p. 718; *With.* vol. iv. p. 106; *Stack. Ner. Brit.* p. 63, t. 12; *Turn. Syst.* vol. ii. p. 226; *Turn. Hist.* t. 216, 217; *Clem. Ess.* p. 313; *Wahl. Fl. Lapp.* p. 497; *E. Bot.* t. 2285.

Fucus *ceranoides*.—*Gm. Hist. Fuc.* p. 115, t. 7, f. 1 (excl. syn. *Linn.*); *Huds. Fl. Angl.* p. 582; *Lightf. Fl. Scot.* p. 913; *Roth, Fl. Germ.* vol. iii. p. 450; *Esper, Ic. Fuc.* vol. i. p. 143, t. 98, f. 1, 2, 3.

Fucus *membranifolius*.—*With.* vol. iv. p. 106 (not of *Good. & Woodw.*).

Fucus *polymorphus*.—*Lamour. Diss.* p. 1 (excluding 4th series).

Fucus *stellatus*.—*Stack. Ner. Brit.* p. 53, t. 12.

Fucus *lacerus*.—*Stack.* l. c. p. 50, t. 11.

Fucus *crispatus*.—*Fl. Dan.* t. 826.

Fucus *filiformis*.—*Huds. Fl. Angl.* p. 585.

Fucus *patens*.—*Good. & Woodw.* in *Linn. Trans.* vol. iii. p. 173.

Hab.—Found on almost every coast of the British Islands, from high to low-water mark and beyond. Perennial. Spring, summer, and autumn. Very common.

Geogr. Dist.—Shores of Europe; eastern shores of North America.

Description.—Root, a minute disc. Stem elongate, one to two inches or more in length, cylindrical at the base, but soon becoming compressed and at length flattened, dichotomously divided into a broad flabelliform frond, much tufted, two to five inches or more in height, and as much in breadth ; the segments broad and obcuneate, and flat or narrow, linear and compressed, but exceedingly variable in breadth, generally from one line to one inch or upwards ; in the broad varieties with wide rounded axils, and the segments greatly expanding upwards and overlapping at the apices, which are obtuse or emarginate. Occasionally the margins, especially in old or injured specimens, are more or less fringed with small leaf-like processes. Structure : axis occupying fully two-thirds of the frond, fibro-cellular, composed of very slender articulated fibres, densely packed and interlaced ; from these arise larger, less densely packed cells, imperfectly arranged in filaments, becoming smaller towards the circumference, where they are very minute, and regularly moniliform. Substance cartilaginous, readily dissolving into gelatine by boiling in fresh water. Colour, a dark reddish brown, which readily changes to a yellowish green on exposure to air and light even when growing, and quickly bleaching to a dull transparent white after being gathered and exposed. Tetraspores forming roundish oblong sori, imbedded in the substance of the frond, occasionally concave on one side.

One of the most polymorphous of British Algæ, growing on almost every "soil and situation" within tide range, and to a considerable distance beyond it, on the larger Algæ as well as on rocks, stones, and even wood, often growing in scattered tufts among *G. mamillosus*, and sometimes covering rocks by itself, generally having the stems half imbedded among the small mussels. The upper portion of the frond is of a yellowish green colour, while the lower part is of the original dark purple, which colour pervades the whole plant when not exposed to the light.

When growing in brackish water the fronds are sometimes of large size, rather soft and flaccid, the segments very broad and crisped, the surface rough and areolated. On this variety we have seen no fruit.

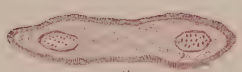
The fronds are at first cylindrical, simple, then compressed, emarginate, bifurcate, and at length flat and repeatedly dichotomous, the dichotomies being seldom of equal length, and the ultimate ones short and obtuse or emarginate.

This is one of the few plants upon which man has condescended to confer a local name, being the Carageen or Irish moss of the shops, where it is sometimes purchased as a light diet for invalids. It was first used, perhaps, in Ireland, hence its by no means appropriate name of Irish

moss, where it was for some time collected along with *Gigartina mamillosa*, and was at one time so much in demand that it was sold at from two or three shillings per pound. The three figures given are what might be called the most common forms this most variable plant assumes. We might have given some dozen figures without exhausting the specimens now before us, each distinct.

EXPLANATION OF PLATE XCI. A, B, C.

Figs. 1. A, B, C.—*Chondrus crispus*, natural sizes.
2.—Section of frond and two sori.
3.—Tetraspores from same. Both magnified.



*Chondrus crispus*, Lyngb.

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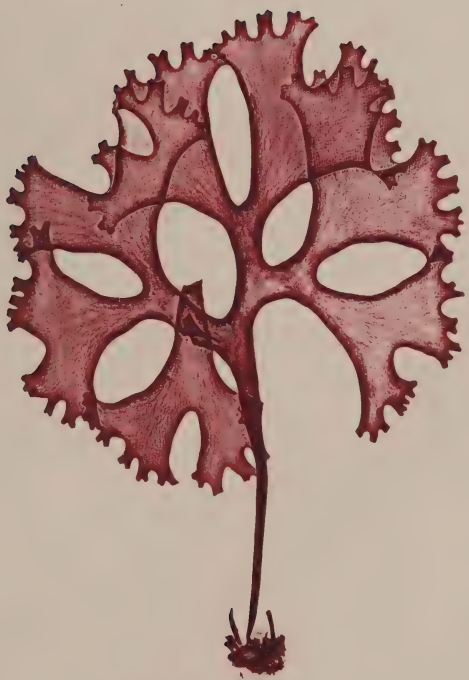

*Chondrus crispus*, Lyngb.

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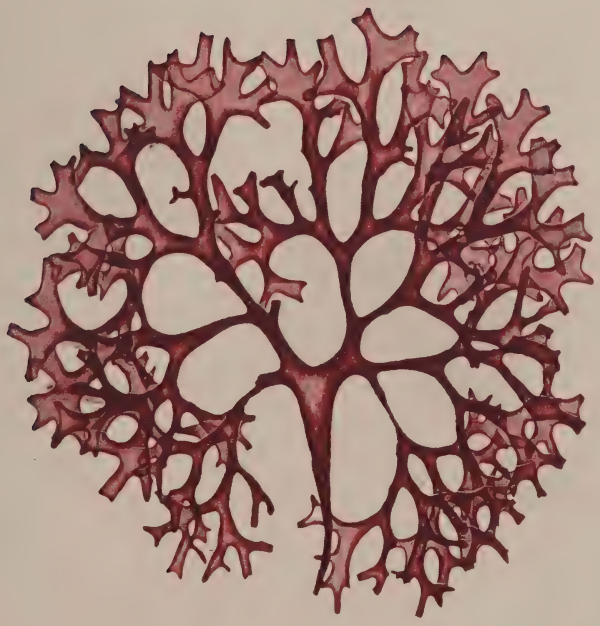

*Chondrus Crispus*, Lyngb.

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# Plate XCII. A, B,

## HALYMENIA LIGULATA.—*Ag.*

Gen. Char.—Frond gelatinoso-membranaceous, flat or compressed, composed of a double membrane of very minute coloured cells, separated by an extremely lax network of jointed fibres. Fructification, consisting of favellidia attached to the inner surface of the membrane. Name from ἁλς, "the sea," and ὑμην, "a membrane."

Halymenia *ligulata*.—Frond shortly stipitate, flat, or in the narrow varieties compressed, irregularly dichotomous, often proliferous from the disc and margin.

Halymenia *ligulata*.—*Ag. Sp. Alg.* vol. i. p. 210; *Ag. Syst.* p. 244; *Spreng. Syst. Veg.* vol. iv. p. 333; *Grev. Alg. Brit.* p. 162, t. 17; *Hook. Br. Fl.* vol. ii. p. 308; *Wyatt, Alg. Danm.* No. 425; *Endl.* 3rd Suppl. p. 40; *Harv.* in *Mack. Fl. Hib.* part 3, p. 188; *Harv. Man.* p. 148; *Harv. Syn.* p. 122; *Atlas*, plate 48, fig. 216; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 201.

Halymenia *elongata*.—*Ag. Sp. Alg.* vol. i. p. 209; *Ag. Syst.* p. 243; *J. Ag. Medit.* p. 98.

Halarachnion *ligulatum*.—*Kütz. Phyc. Gen.* p. 394, t. 74, f. 1.

Ulva *ligulata*.—*Woodw.* in *Linn. Trans.* vol. iii. p. 54; *E. Bot.* t. 420.

Ulva *rubra*.—*Huds. Fl. Angl.* p. 571; *E. Bot.* t. 1627.

Mesogloia *Hudsoni*.—*Ag. Syst.* p. 50 (not of British authors).

Hab.—On rocks, stones, and old shells near low-water mark; oftener to be found in four to twelve fathoms water. Annual. Summer. Not unfrequent on the southern shores of England, east, south, and west coasts of Ireland; scarcer in Scotland, but not uncommon on the Ayrshire coast (*Rev. Dr. Landsborough*); Peterhead (*Mr. T. Bell*); Jersey, very common.

Geogr. Dist.—Atlantic shores of Europe; Mediterranean Sea.

Description.—Root, a very small conical disc. Stem short, a quarter of an inch to one inch long, cylindrical, becoming gradually compressed, and in the broad varieties flattened into a once or twice or many times irregularly dichotomous frond, six to ten or even twenty inches in length; the segments from one-eighth to two inches or more in width, with rather narrow but rounded axils, the disc and margin often beset with proliferous elongations, which are generally small and simple, but occasionally elongated, once or twice divided, acute at the points and attenuated towards the base, sometimes again giving rise to minute processes. Occasionally the branches are regularly dichotomous, but

more generally very irregular, partly dichotomous, partly secund, partly alternately or oppositely pinnated, and every other variety of division may be observed often on the same plant. Professor Harvey enumerates *three* distinct varieties, the chief distinctions being the breadth of the frond, with some minor differences in colour and substance. Structure composed of an axial stratum, consisting of an extremely lax network of very slender shortly articulated fibres, forming the greater portion of the frond, and enclosed in a thin membrane composed of one or two layers of very minute coloured cellules. Substance very soft and gelatinous, adhering closely to paper. Colour, a brownish or reddish pink, becoming darker in drying, and changing to a brownish green in decay. Favellidia abundantly scattered in the form of minute dots, through the principal divisions of the frond, and even extending to the ciliæ. Tetraspores unknown.

An ocean species, and mostly confined in the British Islands to the south and west, becoming rarer as we proceed northwards, although extending its range to the Orkney Islands (*Phyc. Brit.*). We have seen no specimens from the east coast of Britain, although we are informed by the same authority that it has been found on the coast of Norfolk.

It is one of our most variable species, scarcely less so than the preceding, varying greatly in the breadth of its fronds, and in the greater or less number of the proliferous processes, which are often very minute, but frequently prolonged into branches having their apices entire, bifid, laciniated or palmate, and are exactly similar in structure to the rest of the frond, often containing dots of fructification.

The species is occasionally found in rock pools near low-water mark, but is mostly thrown on shore from deep water, or obtained by dredging. The figures given show medium, narrow, and broad states of the fronds.

EXPLANATION OF PLATE XCII. A, B.

Figs. 1. A, B.—*Halymenia ligulata*, natural sizes.
2.—Transverse section of frond.
3.—A favellidium.
4.—Spores from same. All magnified.

*HALYMENIA ligulata, Ag.*

Printed by Henry Bradbury.

*HALYMENIA ligulata, Ag.*

Nature Printed by Henry Bradbury.

# Plate XCIII.

## FURCELLARIA FASTIGIATA.—*Lamour.*

Gen. Char.—Root fibrous ; frond cartilaginous, filiform, solid, the axis consisting of closely packed, interlacing and anastomosing filaments, from which arise vertical, dichotomous filaments, the inner cells of which are large oval, the outer smaller, cylindrical, closely packed. Fructification : 1. Favellæ, formed from the inner cells of the outer stratum ; 2. Tetraspores, pyriform, zonate, formed from the outer large cells of the periphery, of elongate terminal pod-like receptacles. Name from *furcula* or *furcilla*, "a little fork."

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Furcellaria *fastigiata.—Lamour. Ess.* p. 26 ; *Ag. Sp. Alg.* vol. i. p. 103 ; *Ag. Syst.* p. 274 ; *Grev. Fl. Edin.* p. 286 ; *Grev. Alg. Brit.* p. 67, t. 11 ; *Hook. Br. Fl.* vol. ii. p. 283 ; *Wyatt, Alg. Danm.* No. 106 ; *Endl.* 3rd Suppl. p. 38 ; *Kütz. Phyc. Gen.* p. 402, t. 71 ; *Harv.* in *Mack. Fl. Hib.* part 3, p. 190 ; *Harv. Man.* p. 147 ; *Harv. Syn.* p. 120 ; *Atlas*, plate 45, fig. 208 ; *Harv. N. B. A.* part 2, p. 195 ; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 196.

Furcellaria *lumbricalis. —Lamour. Ess.* p. 26 ; *Lyngb. Hyd. Dan.* p. 48, t. 40 ; *Hook. Fl. Scot.* part 2, p. 97 ; *Spreng. Syst. Veg.* vol. iv. p. 315.

Fucus *fastigiatus. — Huds. Fl. Angl.* p. 588 ; *Lightf. Fl. Scot.* p. 930 ; *Gm. Hist.* p. 108, t. 6, f. 1 ; *Good. & Woodw.* in *Linn. Trans.* vol. iii. p. 204 ; *Turn. Syn.* p. 317 ; *Turn. Hist.* t. 6 ; *E. Bot.* t. 824.

Fucus *furcellatus.—Linn. Sp. Pl.* p. 1631 ; *Huds. Fl. Angl.* p. 589.

Hab.—On rocks and stones in tidal pools. Perennial. Winter. Common.

Geogr. Dist.—Atlantic shores of Europe and North America. Northern Ocean.

Description.—Root composed of branching fibres. Stem cylindrical, attenuated at the base, one to three inches long, and half a line to a line in diameter, four to five times dichotomously branched ; the branches cylindrical, nearly erect, with acute angles, terminating in elongate, fusiform, acuminate, pod-like receptacles. Fronds three to ten inches in length, very much tufted. Structure : axis occupying about two-thirds of the diameter, and composed of articulated filaments, very much interlaced and anastomosing ; articulations three to four times as long as broad, from which arise vertical, dichotomous filaments, whose inner cells are large, ovate or obovate, the terminal ones smaller, oblong, compact, forming the surface. Substance cartilaginous, rather rigid and brittle, not adhering to paper. Colour, a dark reddish purple. Favellæ formed

from the innermost of the large cells that form the middle stratum, and consisting of a number of angular spores. Tetraspores formed from the outer cells of the same stratum, pyriform, divided crossways into four sporules.

Until the beautiful analysis given in Plate 94 of *Phyc. Brit.*, the fructification of this common plant was but little known, and looked upon as exceedingly rare, although it does not seem to be by any means uncommon. The plant itself is common all round the British shores, growing at the sides and bottoms of pools between tides, extending a little beyond low-water mark. In shallow pools it is short and stunted, but in deeper water its fronds are long, slender, and brush-like, waving gracefully in the swell as the tide ebbs and flows in its native pool.

So closely allied both in structure and external habit is this plant to *Polyides rotundus*, that one almost feels a regret that the species should be separated. The fructification, however, is so different that it has been found necessary to place them in different families.

From *Polyides rotundus* it may be readily distinguished even in the barren state by its fibrous not scutate roots, and the rather more acute angles of the branches, which are generally more erect.

When in fruit, the curious wart-like processes creeping over the branches of *Polyides rotundus* will at once distinguish them with the least chance of error.

In making sections of this as well as of many other Algæ, much difficulty is often experienced in getting the section to lie flat for microscopical examination. This is often very desirable when these are intended for mounting as objects for the microscope, and can be readily effected by the aid of gum arabic, Canada Balsam, or some similar substance, by which, when pressed down to the glass, they may be retained in the desired position.

EXPLANATION OF PLATE XCIII.

Fig. 1.—*Furcellaria fastigiata*, natural size.
2.—Portion of frond with tips inflated.
3.—Transverse section of receptacle.
4.—Longitudinal section of same. All magnified.

*Furcellaria fastigiata*, Lamour.

Nature Printed by Henry Bradbury.

# Plate XCIV.

## GRATELOUPIA FILICINA.—*Ag.*

Gen. Char. —Frond cartilagino-membranaceous, flat, solid; axis composed of closely interwoven, anastomosing, longitudinal filaments, becoming vertical and dichotomous towards the surface, where the cells are very minute, moniliform and compact. Fructification of two kinds, on distinct plants: 1. Favellidia, formed immediately within the stratum of moniliform cells, and communicating with the surface by a minute pore; 2. Tetraspores cruciate, imbedded among the moniliform cells of the periphery. Name in honour of Dr. Grateloup, a French algologist.

Grateloupia *filicina.*—Frond linear, flat, tapering to each end, bipinnate; pinnæ and pinnulæ resembling the main stem, very patent and flexuose.

Grateloupia *filicina.*—*Ag. Sp. Alg.* vol. i. p. 224; *Syst.* p. 241; *Spreng. Syst. Veg.* vol. iv. p. 334; *Grev. Alg. Brit.* p. 151, t. 16; *Hook. Br. Fl.* vol. ii. p. 306; *Wyatt, Alg. Danm.* No. 123; *J. Ag. Medit.* p. 103; *Endl.* 3rd Suppl. p. 41; *Kütz. Phyc. Gen.* p. 397; *Mont. Fl. Alger.*; *Harv. P. B.* plate 100; *Harv. N. B. A.* part 2, p. 200; *Harv. Man.* p. 137; *Harv. Syn.* p. 111; *Atlas*, plate 40, fig. 186; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 180.

Grateloupia *porracea.*—*Kütz. Phyc. Gen.* p. 397.

Delesseria *filicina.*—*Lamour. Ess.* p. 38.

Gelidium *neglectum.*—*Bory, Fl. Pelop.*

Fucus *filicinus.*—*Wulf.* in *Jacq. Coll.* vol. iii. p. 157, t. 15, f. 2; *Turn. Hist. Fuc.* t. 150; *Esper, Ic. Fuc.* vol. i. p. 134, t. 67.

Hab.—On submarine rocks, between tide-marks. Rare. Perennial. Winter. Sidmouth, Ilfracombe (*Miss Cutler*); Barrowcane and Hagington (*Mrs. Griffiths*); Mounts Bay, Cornwall (*Mr. Ralfs*); Jersey (*Miss Edgar, Mr. F. P. Girdlestone*).

Geogr. Dist.—Atlantic shores of France and Spain; Mediterranean Sea, abundant; Cape of Good Hope; Indian Ocean; Florida, U.S.

Description.—Root, a minute disc. Fronds tufted, linear, flat, tapering towards the base and apex, pinnated or bipinnated, with rather long flexuous pinnæ and pinnules, forming an ovate frond one to three inches in height; pinnæ opposite or alternate, naked towards the base, simple or pinnated in the middle or upper half, more or less regularly; sometimes the branching is irregularly dichotomous, with few short spine-like scattered pinnæ, the apices simple, bifid or forked. Structure composed of articulated filaments, those in the centre longitudinal, interlacing

and anastomosing; articulations cylindrical, becoming vertical and dichotomous towards the surface, where the cells are minute and moniliform. Substance cartilagino-membranaceous, very imperfectly adhering to paper. Colour, a rather dull brownish red, changing to yellowish green in decay. Favellidia formed immediately under the stratum of moniliform cells that compose the periphery, containing numerous minute ovate spores, and communicating with the surface by a minute pore. Tetraspores elliptical, cruciate, immersed among the moniliform filaments of the periphery, and grouped together in imperfect sori in the smaller leaflets of the frond.

This curious little plant has only been found with us in the south of England, but it is by no means common, having there apparently reached its northern limit of distribution, and in its slender form and scanty abundance evincing its citizenship as that of a more southern and more genial clime.

With us it seldom attains the height of three inches, whilst specimens from the south of France are six inches in length, and regularly bipinnated, and we are informed in *Phyc. Brit.* that in more southern latitudes they are even still more luxuriant. We have received specimens from Jersey, one in particular (which has passed through Dr. Harvey's hands, and on which he has written "a superb specimen") gathered by our indefatigable friend Mr. Girdlestone, that is quite seven inches in height, and formed very much like a handsome Spruce Fir; others are from three to five inches. Our figure is from one of the said specimens.

Although by no means sportive in its habit, it very closely resembles in its less regularly pinnated forms some of the more straggling varieties of *Gelidium corneum*, but from these it can be readily distinguished by its more flaccid substance, and the difference of structure under the microscope will be apparent at the first glance. The fruit of the two species could scarcely be more different.

EXPLANATION OF PLATE XCIV.

Fig. 1.—*Grateloupia filicina*, natural size.
2.—Pinna with tetraspores in leaflets.
3.—Tetraspores from same.
4.—Pinna with tubercles.
5.—Transverse section of same. All magnified.

*Grateloupia filicina. Ag.*

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# Plate XCV.

## SCHIZYMENIA DUBYI.—*J. G. Ag.*

Gen. Char.—Frond subcarnose-membranaceous, flat, composed of two strata: the inner of longitudinal, anastomosing and interlacing, articulated filaments; the outer of cells, of which the inner are large, ovate, irregular, the outer smaller, and disposed in moniliform vertical series. Fructification of two kinds, on distinct plants: 1. Favellidia, more or less immersed in the substance of the frond; 2. Tetraspores, tripartite or cruciate, scattered among the filaments of the periphery. Name from σχίζω, "I divide," and ὑμὴν, "a membrane."

Schizymenia *Dubyi*.—Frond submembranaceous, thin, flat, obovate or oblong ovate, sometimes divided to the base into linear, oblong or obovate laciniæ or segments.

Schizymenia *Dubyi*.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 171.

Kallymenia *Dubyi*.—*Harv. P. B.* plate 123; *Harv. Man.* p. 150; *Harv. Syn.* p. 123; *Atlas*, plate 47, fig. 214.

Halymenia *Dubyi*.—*Chauv. Bot. Gall.* p. 944.

Halymenia *laminarioides*.—*Bory*, sec. *Lenorm.*

Nemostoma *Dubyi*.—*J. Ag. Alg. Medit.* in not. p. 96.

Iridæa *Dubyi*.—*Lenorm.* in *Herb.*

Delesseria *Ferrarii*.—*Bonnem. et Lamour.* sec. *Lenorm.*

Hab.—On rocks, stones, &c., within tide-marks. Annual. Spring and early summer. Falmouth Harbour (*Miss Warren*); Plymouth (*Rev. W. S. Hore, J. W. Rohloff*); Carnlough Bay, 1833 (*Miss Davison*); Belfast Bay in ten fathoms (*W. Thompson*); Glenarm, co. Antrim, Ireland (*D. Moore*).

Geogr. Dist.—Atlantic coasts of France and Spain.

Description.—Root, a small flat disc. Stem very short, scarcely a quarter of an inch long, cylindrical at the base, but immediately expanding into the base of the frond, whose normal form is obovate, entire, six inches to a foot in length, somewhat tufted, the margin quite entire, but more or less full and undulating, broad and rounded at the summit, but gradually tapering to the base: frequently, however, the frond is cleft nearly to the base, the divisions assuming the normal form, or are more or less oblong, entire, or again cut or cleft more or less deeply; sometimes the frond is entire, oblong, or roundish oblong, and nearly as wide in the lower as in the upper half. Structure consisting of an axis, occupying one-half the diameter, and composed of slender articulated

filaments, densely packed, and interlacing and anastomosing, the articulations long, swollen at the ends, and partially filled with a slender thread of endochrome; the outer part of the frond composed of cells, those next the axis large, roundish oval, irregular, those towards the surface minute, arranged in vertical moniliform series. Substance subcarnose, very soft when fresh, firm when dry, and the younger parts only perfectly adhering to paper. Colour, a rather dull brownish red, reddish pink in the Irish specimens. Favellidia, minute dots scattered over the whole surface of the frond, attached to the inner surface of the cellular periphery, and slightly prominent on the surface. Tetraspores we have not seen.

This fine species it has been thought desirable to remove from *Kallymenia* and unite with *Iridæa*, with which it seems to have a closer affinity both in structure and fructification. The name is more applicable to *S. edulis* than to the present species, which is thinner, more flexible, and less brittle than in that species, and less liable to be torn or split by the action of the waves.

Miss Warren's specimens from Falmouth Harbour are of a rather deep brownish red colour, darker towards the base, and not unlike in tint some of the varieties of *Rhodymenia palmata*, but the substance, when fresh, is much more soft and flaccid.

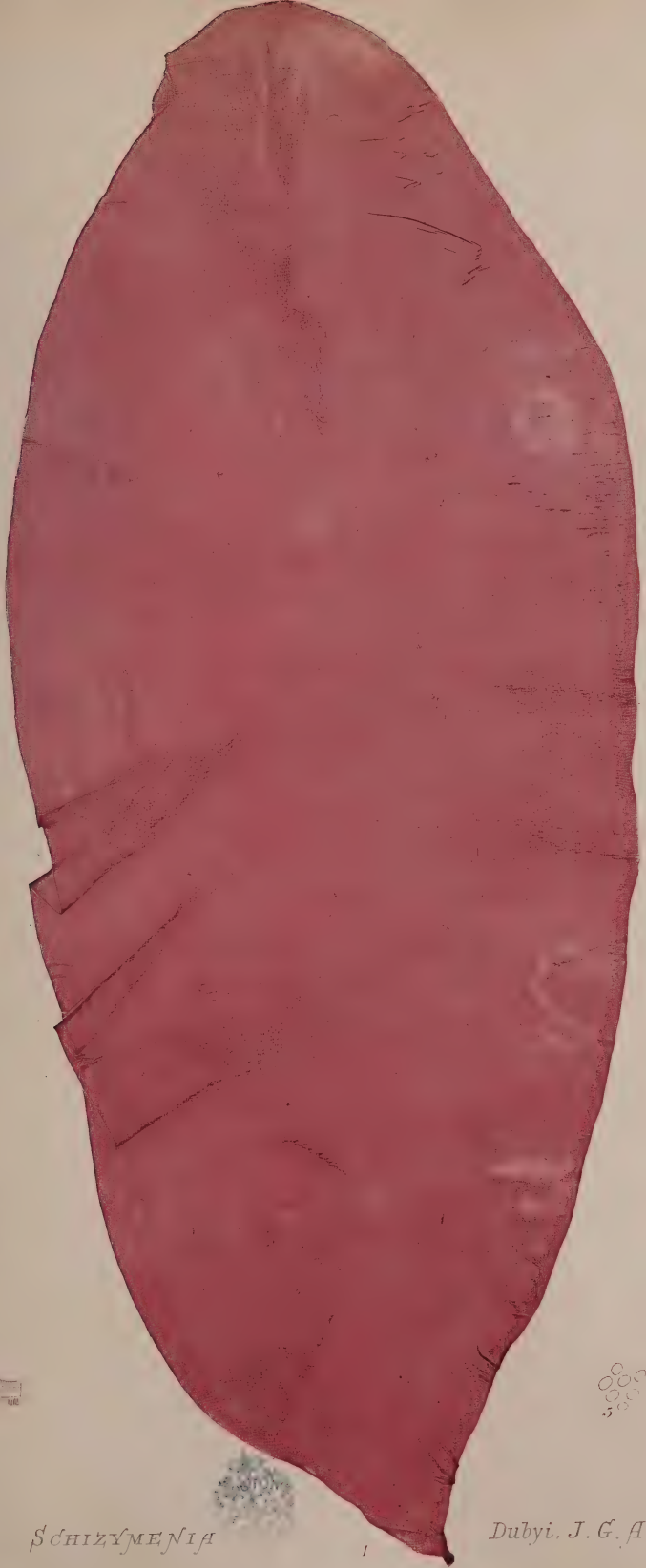
The Irish specimens, on the contrary, kindly sent us by Mr. D. Moore, of Dublin, are of a rather bright brownish red, and somewhat glossy, being much less deep than those of Miss Warren, and are without fruit.

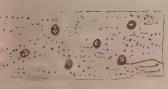
From *S. edulis* it may be readily known by its much thinner and less rigid fronds, the smaller cells of the base of the vertical filaments, and very slender filaments of the axis.

It is still a desideratum in the Flora of Scotland, although two stations are given in the Orkney Islands.

EXPLANATION OF PLATE XCV.

Fig. 1.—*Schizymenia Dubyi*, natural size.
2.—Portion of frond with favellidia.
3.—Section of same.
4.—A favellidium.
5.—Spores from same. All magnified.





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SCHIZYMENIA Dubyi. J. G. Ag.

1

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# Plate XCVI.

## SCHIZYMENIA EDULIS.—*J. G. Ag.*

Gen. Char.—Frond subcarnose-membranaceous, flat, composed of two strata: the inner of longitudinal, anastomosing and interlacing, articulated filaments; the outer of cells, of which the inner are large, ovate, irregular, the outer smaller, and disposed in moniliform vertical series. Fructification of two kinds, on distinct plants: 1. Favellidia, more or less immersed in the substance of the frond; 2. Tetraspores, tripartite or cruciate, scattered among the filaments of the periphery. Name from σχίζω, "I divide," and ὑμήν, "a membrane."

Schizymenia *edulis*.—Frond carnoso-cartilaginous, thick and rigid, obovate, gradually tapering into a short stem at the base.

Schizymenia *edulis*.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 172.

Iridæa *edulis*.—*Bory*, in *Dict. Class. d'Hist. Nat.* vol. ix. p. 15; *Grev. Alg. Brit.* p. 158, t. 17; *Hook. Br. Fl.* vol. ii. p. 308; *Wyatt, Alg. Danm.* No. 78; *Endl.* 3rd Suppl. p. 37; *Kütz. Phyc. Gen.* p. 396; *Harv.* in *Mack. Fl. Hib.* part 3, p. 189; *Harv. P. B.* plate 97; *Harv. Man.* p. 150; *Harv. Syn.* p. 123; *Atlas*, plate 47, fig. 215.

Halymenia *edulis*.—*Ag. Sp. Alg.* vol. i. p. 202; *Ag. Syst.* p. 242; *Hook. Fl. Scot.* part 2, p. 107; *Spreng. Syst. Veg.* vol. iv. p. 333.

Delesseria *edulis*.—*Lamour. Ess.* p. 38.

Ulva *edulis*.—*De Cand. Fl. Fr.* vol. ii. p. 12; *Grev. Fl. Edin.* p. 298.

Fucus *edulis*.—*Stack. Ner. Brit.* p. 57, t. 12; *With.* vol. iv. p. 101; *Turn. Syn.* vol. i. p. 180; *Turn. Hist.* t. 114; *E. Bot.* t. 1307; *Hook.* in *Fl. Lond.* cum icone.

Fucus *dulcis*.—*Gm. Hist. Fuc.* p. 189, t. 26 (figure only).

Fucus *lactuca*.—*Esepr, Ic. Fuc.* vol. i. p. 129, t. 64.

Fucus *carnosus*.—*Schmidel, It.* p. 76; *Esp.* l. c. p. 150, t. 76.

Fucus *palmatus*, β.—*Lightf. Fl. Scot.* p. 935.

Hab.—On rocks and stones and old shells, near low-water mark. Perennial. Fruit in winter. Common all round the British Islands.

Geogr. Dist.—Atlantic shores of Europe; Baltic Sea; Malaga (*Ag.*).

Description.—Root, a broad flattened disc. Stem short, a quarter of an inch to an inch long, gradually tapering into the wedge-shaped base of the frond, which is obovate, broad, and rounded at the extremity, margin plane and entire, very slightly if at all waved; such is the normal form, but wide alterations frequently occur. The base is generally long and tapering, from about one-third to the summit, but frequently it is so

suddenly and so greatly expanded as to be almost cordate, the upper part of such specimens as we have seen in this state being more or less abraded and split into laciniæ ; occasionally the form is oblong, the sides nearly straight, the apex rounded, and the base with rounded angles suddenly tapering into the footstalk ; various other less marked deviations may be observed. Structure consisting of two strata ; central of longitudinal, articulated, interlacing filaments, the articulations cylindrical, filled with endochrome. On these are laid several series of rather large roundish ovate cells, becoming smaller towards the surface, where they are arranged in regular vertical moniliform series. Substance carnoso-cartilaginous, rather thick and firm, imperfectly adhering to paper. Colour, a deep dark purple, the old fronds becoming almost black when dry, changing to a pale ochry red and greenish orange in decay. Favellidia, formed among the inner cells of the periphery, minute, dot-like, very slightly elevated, filled with minute ovate or angular spores. Tetraspores in irregular scattered masses among the inner cells of the periphery, roundish ovate, triparted or irregularly cruciate.

A common plant on all our shores, frequenting deep rock-pools near low-water mark, and frequently found also on exposed rocks and stones on a shelving shore. It is much more easy however to obtain specimens than to find good ones, as there is no plant more liable to be injured by the violence of the waves and by the attacks of marine animals.

Frequently the frond continues to grow after being split, and this adds considerably to the irregularity of its form, the upper part of the segments often overlapping. Not unfrequently also one side or one angle becomes much more developed than the other, and the frond is thus rendered very oblique. Generally it is very straight and stiff, but not unfrequently curves gracefully to one side, and is truly pyriform.

This species may be readily known from the last by its dark purple colour and thick fleshy substance.

The term *edulis* is very applicable as far as marine animals are concerned, for no plant seems a greater favourite, and it is very difficult to find a frond of any size from which a slice has not been stolen to form a dinner for some gourmand mollusc.

EXPLANATION OF PLATE XCVI.

Fig. 1.—*Schizymenia edulis*, natural size.
2.—Section of frond with favellidia.
3.—Spores from same.
4.—Section of frond with tetraspores.
5.—Tetraspores. All magnified.

1

4

3

2

5

*Schizymenia edulis*, J. G. Ag.

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# Plate XCVII.

## GLOIOSIPHONIA CAPILLARIS.—*Carm.*

Gen. Char.—Frond gelatinous, filiform, tubular; inner part of the tube composed of longitudinal, anastomosing and interlacing filaments, the outer of minute cells disposed in vertical moniliform series. Fructification: favellidia, immersed among the vertical filaments, "to whose bases they are attached." Name from γλοιὸς, "viscid," and σίφων, "a tube."

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Gloiosiphonia *capillaris.—Carm. Alg. Appin. MS.*; *Berk. Gl. of Br. Alg.* t. 17, f. 3; *M'Calla, Alg. Hib.*; *Harv.* in *Mack. Fl. Hib.* part 3, p. 187; *Harv. P. B.* plate 57; *Harv. Man.* p. 152; *Harv. Syn.* p. 125; *Atlas*, plate 48, fig. 219; *Harv. N. B. A.* part 2, p. 202; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 161.

Mesogloia *capillaris.—Ag. Syst.* p. 51; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 386.

Gigartina *capillaris.—Lamour. Ess.*

Gigartina *lubrica.—Lyngb. Hyd. Dan.* p. 45, t. 12 (sec. *Ag.*).

Fucus *capillaris.—Huds. Fl. Angl.* p. 591; *With.* vol. iv. p. 115; *Turn. Syn.* vol. ii. p. 370; *Turn. Hist.* t. 31; *E. Bot.* t. 2191.

Hab.—On submarine rocks; in tide-pools near low water; often cast on shore from deep water. Annual. Summer. Not uncommon from Jersey to Orkney, as well as on the Irish coasts. Particularly abundant at Peterhead on sandy rocks, as well as on slightly muddy bottoms (*Mr. T. Bell*). Forfarshire and Moray Frith (*A. C.*); rather scarce in clear shallow pools near low water.

Geogr. Dist.—Atlantic shores of Europe.

Description.—Root, a minute disc. Fronds much tufted, filiform, from a slender base, gradually thickening upwards to the middle, and then tapering to a point; about one-twelfth of an inch in diameter at the thickest part, and from three to ten or twelve inches in length, irregularly branched from near the base with branches similar to the main stem, and these are again repeatedly subdivided in like manner, all the branches being rather patent, shorter and more slender upwards, giving the frond and all its divisions an ovate outline; sometimes the main stem is branched from the base, but more frequently it is naked for one or even two inches, and all the divisions are much attenuated towards the base and taper to a long slender point. Structure consists of a thin tube formed of two strata: the inner composed of longitudinal articulated, anastomosing and interlacing fibres, with short oblong joints, traversed by a very narrow thread of endochrome, the outer of vertical moniliform filaments, the whole set in a very lax transparent jelly. Substance gelatinous, exceedingly soft and lubricous,

and firmly adhering to the paper. Colour, a fine clear transparent rosy pink. Favellidia, generally abundant in the form of small red dots scattered among the vertical filaments, and consisting of a mass of minute spores. Tetraspores we have not seen.

This is one of the most beautiful as well as one of the most interesting of our marine Algæ, and no less so on paper than under the microscope. Its soft, mellow, transparent colour, and light delicate branching render it a very pretty object on paper, and the structure is so loose, every filament standing so distinct and wide apart from its neighbour, that when placed under the microscope its structure may be best understood by comparing it to a minute microscopic *Callithamnion*, growing in a small tube of sea-water which had suddenly congealed around it. When the surface is placed under the microscope, nothing is seen but the terminal cells of the vertical filaments, which look like so many Argus eyes set in crystal. A living plant, in full fruit, placed in a vial of sea-water, is a beautiful object. The rich transparency of the stems and branches enables every little globule of fruit to be distinctly seen, even by the naked eye, they appear like apples of ruby on a tree of carnelian.

The plant does not seem to be abundant anywhere, but has been found all round our coasts in small quantities, and its appearance also, like many other land and sea plants, is said to be uncertain.

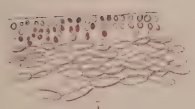
On the east and west coasts of Scotland we have gathered it frequently, generally in clear shallow tide-pools, near low-water mark, though occasionally within the margin of deep pools near the surface, always in places exposed to the sun, the specimens generally rather small, but fruiting abundantly.

We have seen some straggling form of *Chylocladia clavellosa* somewhat resembling it, but the structure is so different that the least examination will at once decide the species. It has a much nearer affinity to *Dudresnaia divaricata*, but from that the fistulose stem will readily distinguish it.

The structure and lubricity is also very much the same as that of the *Mesogloiæ* among the Melanosperms, but from these the colour and fructification remove it *longo intervallo*.

EXPLANATION OF PLATE XCVII.

Fig. 1.—*Gloiosiphonia capillaris*, natural size.
2.—Branchlet with favellidia.
3.—Transverse section of a favellidium.
4.—Vertical filaments.
5.—Longitudinal filaments. All magnified.



*Gloiosiphonia capillaris, Carm.*

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# Plate XCVIII.

## SPYRIDIA FILAMENTOSA.—*Harv.*

Gen. Char.—Frond cellular, filiform, cylindrical, tubular, articulated, much branched; branches beset with simple articulated setaceous ramuli. Fructification of two kinds, on distinct plants: 1. Stalked favellæ, two to three lobed, and furnished with several short setaceous involucral leaves at the base; 2. Tetraspores, triparted, sessile on the ramuli. Name from σπυρὶς, "a basket."

Spyridia *filamentosa.*—Frond much and irregularly branched; branches tapering to the base and apex, everywhere beset with short setaceous or somewhat club-shaped ramuli; joints of the stem much shorter, of the ramuli rather longer than broad.

Spyridia *filamentosa.*—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 337; *Wyatt, Alg. Danm.* No. 88; *J. Ag. Alg. Medit.* p. 79; *Endl.* 3rd Suppl. p. 35; *Kütz. Phyc. Gen.* p. 376, t. 48; *Mont. Pl. Cell. Canar.* p. 174; *Harv. P. B.* plate 46; *Harv. Man.* p. 166; *Harv. Syn.* p. 137; *Atlas*, plate 53, fig. 244; *Harv. N. B. A.* part 2, p. 204.

Spyridia *crassiuscula.*—*Kütz. Phyc. Gen.* p. 376.

Spyridia *setacea.*—*Kütz.* l. c.

Spyridia *mediuscula.*—*Kütz.* l. c.

Fucus *filamentosus.*—*Wulf. Cr. Ag.* p. 64.

Fucus *friabilis.*—*Clem. Ess.* p. 318.

Ceramium *filamentosum.*—*Ag. Sp. Alg.* vol. ii. p. 141.

Hutchinsia *filamentosa.*—*Ag. Syst.* p. 159.

Conferva *Griffithsiana.*—*E. Bot.* t. 2312.

Hab.—On rocks, near low-water mark. Perennial. Summer. Not uncommon along the southern shores of England; Aberfraw, Anglesea; Jersey. Unknown on the Scottish and Irish shores.

Geogr. Dist.—Atlantic coasts of Europe; Mediterranean Sea, abundant; East and West Indies; Canary Islands; Australia; Tasmania.

Description.—Root, a large common disc, from which the stems are numerous, cylindrical, filiform, tubular and jointed, three to six or eight inches long, and nearly half a line in diameter below, gradually tapering to the apex, much branched very irregularly, sometimes alternate, sometimes opposite, at one time dichotomous, at another fastigiate, and these branches again three to four times similarly divided; the stem and lower branches or their lower portions being naked, but all

# Plate XCIX.

## MICROCLADIA GLANDULOSA.—*Grev.*

Gen. Char.—Frond subcartilaginous, filiform, compressed, formed of three strata; axis consisting of a rather thick articulated filament, surrounded by a single series of very large oval, coloured, vertical cells, the periphery of minute compressed cellules. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, sessile, surrounded at the base by several spine-like, incurved, involucral ramuli; 2. Tetraspores, triparted or cruciate, immersed in the ramuli. Name from μικρὸς, "small," and κλάδος, "a branch."

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Microcladia *glandulosa.*—*Grev. Alg. Brit.* p. 99, t. 13; *Hook. Br. Fl.* vol. ii. p. 293; *Wyatt, Alg. Danm.* No. 68; *Kütz. Phyc. Gen.* p. 382; *Endl.* 3rd Suppl. p. 36; *Harv. P. B.* plate 29; *Harv. Man.* p. 160; *Harv. Syn.* p. 130; *Atlas*, plate 51, fig. 230; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 151.

Delesseria *glandulosa.*—*Ag. Sp. Alg.* vol. i. p. 182; *Ag. Syst.* p. 251; *Jones & Kingst. Fl. Devon.* part 2, p. 66.

Fucus *glandulosus.*—*Soland. MS.*; *Turn. Hist.* t. 38; *E. Bot.* t. 2135.

Hab.—On rocks in the sea, on Algæ and sponges, near low-water mark, and to a greater depth. Rare. Annual. Summer. Budleigh, Salterton, and Torquay (*Mrs. Griffiths*); Falmouth (*Miss Warren*); Teignmouth (*Mr. Ralfs*).

Geogr. Dist.—As above; Atlantic shores of France and Spain; Marseilles (*Kützing*); Kamtschatka (*Agardh*).

Description.—Root composed of small branching fibres. Frond, densely tufted, one to two inches high, and from one-sixth to one-fourth of a line in diameter, much and repeatedly branched from the base in a somewhat irregularly dichotomous manner; branches distichous, somewhat zig-zag, erecto-patent, giving it a roundish outline; the axils wide and rounded; the ultimate ramuli short, rather obtuse, and somewhat incurved. Structure: the axis consists of a simple, rather stout, articulated filament, composed of roundish oblong cells, around which are built endwise a single layer of oblong, vertical, coloured cells, and these are covered by a thin coating of minute compressed cellules, forming the periphery. When this is viewed from without, it presents the appearance as if the cellules were disposed in large areolæ, with transparent interstices, from the large coloured cells beneath appearing through them. Substance rather firm and cartilaginous in the older

parts, and scarcely adhering to paper; softer when young and rather adhesive. Colour, a rather bright brownish rose red, duller when dry. Favellæ sessile on the smaller branches, formed by the metamorphosis of a ramulus, roundish with a thin pellucid limbus, filled with minute oval spores, and having at the base three to five short setaceous incurved involucral teeth or ramuli, scarcely longer than the favella. Tetraspores triparted or quadriparted, immersed in the upper ramuli, and generally arranged in linear series within the under edge of the ramulus.

This interesting little plant appears mostly confined in this country to the south-west of England and south-east of Ireland, and is by no means abundant anywhere. Although we may reasonably conclude that from its small size and somewhat uncertain appearance it may have frequently eluded observation, and many of its habitats, now so few and far between, may still be unknown, yet so far as we yet know of its geographical distribution, it seems to be but limited and scanty.

Miss Warren, whose specimens we have chiefly seen, informs us that its appearance is somewhat uncertain. This uncertainty in appearance both of terrestrial and marine plants, we believe, has not yet been sufficiently explained.

We have often remarked the fact, but could never sufficiently explain it, that both marine and land plants would make their appearance abundantly in a locality in one season, and would not be seen there for many years to come. The remark, we believe, is applicable only to such species as are annual in their duration, and the circumstance is perhaps less to be wondered at with respect to plants that inhabit the sea than those that inhabit the land, as the seeds of the latter being generally dropped where they grow, one would naturally expect them to spring up most readily when fresh, while the former are liable to be torn up by the tides of the ocean, and carried off root and branch. Probably they may be deposited in places far remote, there to decay, and their spores attaching themselves to the rocks, they may thus vegetate in places where they had not even existed before, whilst the habitat of the parent plant may be entirely lost till restored by some future wave in the same manner as it had been carried off.

The only species likely to be mistaken for *Microcladia glandulosa* are some of the smaller forms of *Plocamium coccineum*, but the secund ramuli of the one, and the incurved apices of the other, will generally serve to distinguish them, and should that fail, the structure under the microscope cannot be mistaken.

The structure of the present genus is not widely different from that of *Ceramium*, but here the coating of cells is without the tube, whilst

in *Ceramium* it is within, the middle stratum of large cells is entirely wanting, and in most of the species the small cells only extend a little way on each side of the dissepiment.

EXPLANATION OF PLATE XCIX.

Fig. 1.—*Microcladia glandulosa*, natural size.
2.—Branchlet with favella.
3.—Branchlet with tetraspores.
4.—Tetraspores.
5.—Transverse section of stem.
6.—Longitudinal section of stem. All magnified.

1

3 4 5 2 6

*Microcladia glandulosa*, Grev.

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## Plate C.

## CERAMIUM RUBRUM.—*Ag.*

Gen. Char.—Frond filiform, single tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from κέραμος, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *rubrum.*—Fronds filiform, much branched; main divisions dichotomous, lesser ones irregular, capillaceo-multifid, the whole of the articulations pervaded by coloured cells; those of the main stems about twice, those of the ramuli half as long as broad; favellæ globose, surrounded by about four spine-like ramuli.

Ceramium *rubrum.*—*Ag. Syn.* p. 60; *Lyngb. Hyd. Dan.* p. 118, t. 62 B, 1; *Hook. Fl. Scot.* part 2, p. 84; *Ag. Syst.* p. 135; *Grev. Fl. Edin.* p. 310; *Ag. Sp. Alg.* vol. ii. p. 146; *Wyatt, Alg. Danm.* No. 42; *J. Ag. Alg. Medit.* p. 81; *Endl.* 3rd Suppl. p. 36; *Kütz. Phyc. Gen.* p. 381; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 336; *Harv.* in *Mack. Fl. Hib.* part 3, p. 210; *Harv. P. B.* plate 181; *Harv. Man.* p. 161; *Harv. Syn.* p. 130; *Atlas*, plate 53, fig. 242; *Harv. N. B. A.* part 2, p. 213; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 127.

Ceramium *virgatum.*—*Roth, Cat. Bot.* vol. i. t. 8, f. 1; *Fl. Germ.* p. 461.

Ceramium *elongatum.*—*Roth, Cat. Bot.* vol. ii. p. 178; *De C. Fl. Fr.* vol. ii. p. 44.

Ceramium *axillare.*—*De C. Syn.* p. 9.

Ceramium *nodulosum.*—*Ducleauz. Ess.* p. 61; *De C. Syn.* p. 9.

Conferva *rubra.*—*Huds. Fl. Angl.* p. 600; *With. Br. Pl.* vol. iv. p. 138; *E. Bot.* t. 1166; *Dillw. Conf.* t. 34; *Fl. Dan.* t. 1482.

Conferva *nodulosa.*—*Lightf. Fl. Scot.* p. 994.

Conferva *tubulosa.*—*Huds. Fl. Angl.* p. 600.

Conferva *flosculosa.*—*Ellis, Phil. Tr.* 57, p. 425, t. 18.

Var. β. *secundatum.*—Lateral ramuli mostly secund.

*Harv. P. B.* descrp. plate 181; *Lyngb. Hyd. Dan.* p. 119, t. 18; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 127.

Hab.—Growing on rocks, stones, old shells, and the smaller Algæ in rock-pools, from high to low-water mark; also in deep water. Annual. Summer. Very common.

Geogr. Dist.—Throughout the temperate zones of both hemispheres; also in the tropical ocean, east and west.

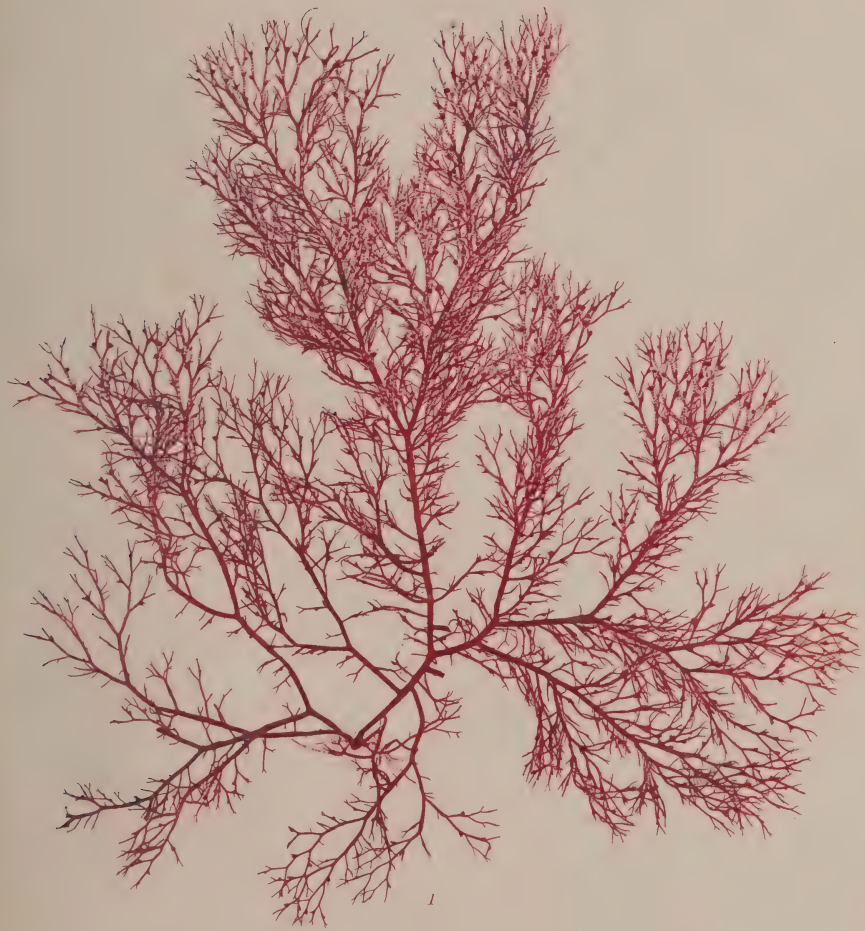
Description.—Root, a minute conical disc. Fronds filiform, single or more or less tufted, three to ten or twelve inches long, and from a quarter to half a line in diameter, much branched from near the base, where it is slightly attenuated; main branches dichotomous, nearly cylindrical, erecto-patent; ramuli short multifid, erect or very patent, sometimes secund, irregularly dichotomous, forked at the extremities, the apices incurved, occasionally straight, articulated throughout, and constricted at the joints; the articulations of the main branches about twice those of the ramuli, about half as long as broad, entirely pervaded by coloured cells. Substance membranaceous, rather flaccid, and generally adhering to paper. Colour, a fine deep transparent rather permanent red, changing in age to greenish, and in decay to a more or less yellowish green, or at length dull white. Favellæ, formed by the metamorphosis of one of the forks of the ramuli (?), roundish, containing numerous angular spores, inclosed in a thick limbus, and having at the base two to four short articulated spine-like ramuli about the length of the capsule; not uncommon. Tetraspores wholly immersed, and arranged circularly round the middle of the joints of the upper ramuli, tripartite, generally abundant during the summer.

The genus *Ceramium* is very closely related to *Microcladia* both in structure and fructification, but may be readily distinguished from it by the absence of the large coloured cells, rendering the articulations of the tube distinctly visible externally.

The present fine species is one of the most widely distributed of the Rhodosperms, if not of marine Algæ, and generally occurs in great abundance, growing on rocks, stones, old shells, and other Algæ, and in every situation, from high-water mark to a considerable distance beyond the lowest "spring tides," and consequently presenting almost every possible form of size, form, and colour—from the pale green, sickly-looking scrubby dwarfs of the shallow tide-pool near high-water mark, with only a few stunted branches, to the fine luxuriant plants from deep water, often upwards of a foot in length, and of a fine deep pinky red colour. Frequently however the main stems and branches have more or less of a greenish tint; and when growing in shallow pools, much exposed to the sun, they soon become of a yellowish or yellowish white. So common is this species that in traversing the shore we scarcely find a pool without its specimen, and not unfrequently we meet with low lying shallow pools entirely filled with it; and, unlike many of its more fastidious neighbours, growing on rocks, stones, shells, and every species of Algæ within reach, even those species of less dimensions than itself are not exempted from its parasitical attacks, as it is not unfrequently found infesting Confervæ and other filiform species.

## EXPLANATION OF PLATE C.

Fig. 1.—*Ceramium rubrum*, natural size.
2.—Apex of branch.
3.—Apex of branch with favella.
4.—Same, more magnified.
5.—Portion of branch with tetraspores.
6.—Tetraspore from same. All magnified.



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5 6 4 3 2

CERAMIUM rubrum. Ag.

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## CERAMIUM BOTRYOCARPUM.—*Griff.*

Gen. Char.—Frond filiform, single tubed, articulated ; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants : 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli ; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher ;" but the name is not applicable to the fruit of any species of the genus as now restricted.

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Ceramium *Botryocarpum.—Griff.* in *Herb.* ; *Harv. Phyc. Gen.* in list of species, vol. i. plate 11 ; *Harv. P. B.* plate 215 ; *Harv. Man.* p. 161 ; *Harv. Syn.* p. 131 ; *Atlas*, plate 53, fig. 243.

Ceramium *rubrum*, *γ proliferum.—Harv. N. B. A.* part 2, p. 214 ; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 127.

Hab.—On rocks and Algæ between tide-marks. Annual ? Summer. Discovered on Preston Rocks, Torquay (*Miss Amelia A. Griffiths*, 1844). Not uncommon ?

Geogr. Dist.—— ?

Description. — Root, a small conical disc, "with imperfect fibres." Fronds two to five inches long, one-sixth of a line in thickness, much branched dichotomously ; branches filiform, and nearly of equal thickness, tapering upwards to a fine point, and everywhere more or less beset with short, mostly fusiform ramuli, which are generally simple, rarely forked, and occasionally become converted into multifid branchlets ; the ramuli are inserted very irregularly round the stem, and are occasionally straight, but more frequently curved upwards, and are generally much attenuated to the base, and taper to a rather blunt point ; lower articulations one and a-half or twice as long as broad, becoming shorter upwards, those of the ramuli scarcely so long as broad; dissepiments constricted. Substance somewhat cartilaginous, adhering rather imperfectly to paper. Colour, rather dark dull brownish red, the older parts frequently greenish, changing to yellowish or greenish white in decay. Favellæ we have not seen ; they are described as forming naked masses on the ramuli, mostly without involucral spines, although these are described by Dr. Harvey as being occasionally present. Tetraspores are common, and are immersed in the articulations, in which they form a ring as in *C. rubrum*.

We must candidly acknowledge that we are not very sanguine as to

the stability of this species, at least as at present characterised. We have seen no specimens with favellæ (?) so characteristic as those from Torquay, but specimens otherwise agreeing very well with the description in *Phyc. Brit.* are not uncommon, and if we are correct in our ideas of the species, it does not seem to be of rare occurrence : at the same time we are by no means certain of the permanency of any of the characters. Specimens of *C. rubrum* are very common, with wart-like excrescences, much like the favellæ of *C. Botryocarpum*, scattered over the whole plant, while specimens are equally common with some of the apices straight, and others forked and incurved. *C. rubrum*, however, is such a variable plant, even in the number of its involucral ramuli, that we have often had our doubts whether more than one species was not still included under the name. Professor Harvey remarks that the present species may be known from *C. rubrum* by its peculiar favellæ and the straight apices of the branchlets, but expresses his doubts as to the favellæ. We must acknowledge a similar doubt, not having been able to find anything like true spores in any of them ; they appear, in fact, to be nothing more than warty excrescences filled with endochrome, somewhat more condensed and granular than that in the ordinary cellules of the plant, and very much resembling those commonly found on *C. rubrum* as well as on *Hypnea purpurascens*, *Fucus vesiculosus*, and many other Algæ.

Many of the specimens sent under the present name, we have been reluctantly compelled to refer to *C. rubrum*, particularly a slender form with a single involucral spine under the cluster of favellæ. This spine is generally rather more slender and rather larger than usual, and is sometimes so much elongated as to give the fruit the appearance of being axillary.

CERAMIUM BOTRYOCARPUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Ramulus with favellæ ?
2.—Same.
3.—Portion of ramulus with tetraspores.
4.—Tetraspore from same. All magnified.

## CERAMIUM DECURRENS.—*Kütz.*

Gen. Char.—Frond filiform, single-tubed, articulated ; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants : 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli ; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher ;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *decurrens.*—Fronds rather stout, cylindrical, attenuated towards the points, much branched, main divisions dichotomous, with scattered, simple or compound lateral branchlets ; articulations about as broad as long at the base, upper twice or twice and a-half as broad as long ; the coloured cellules extending to near the middle.

Ceramium *decurrens.—Harv. P. B.* plate 276 ; *Harv. Man.* p. 162 ; *Harv. Syn.* p. 131 ; *Atlas*, plate 51, fig. 231.

Ceramium *rubrum*, var. *α decurrens.—J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 127.

Hormoceras *decurrens*, *β majus.—Kütz.* in *Linn.* vol. xv. p. 733 ; *Kütz. Phyc. Gen.* p. 379 ; *Sp. Alg.* p. 675.

Hab.—On the smaller Algæ in tide-pools. Rare ? Annual. August. On the Harbour at Torquay (*Mrs. Griffiths*, 1844) ; Largo, Fife, 1846 ; Ayrshire coast (*Rev. Dr. Landsborough*).

Geogr. Dist.—Mediterranean Sea.

Description.—Root, a very small spreading conical disc. Fronds filiform, cylindrical, attenuated towards the points, three to six inches long, one-sixth of a line in thickness, much branched ; main divisions more or less regularly dichotomous, everywhere beset with few, scattered, simple or three to four times divided ramuli. Articulations in the lower part of the stem about as long or a little longer than broad, gradually becoming shorter upwards, those at the points much shorter than broad, and having the coloured cellules extending over the whole of the articulation, except about one-fourth in the middle ; apices forked and incurved. Substance "membranous, not very closely adhering to paper."—*Phyc. Brit.* Colour, a rather pale purplish red, yellowish white in decay. Fructification we have not seen.

This species seems still to be very imperfectly understood in this country. We have seen no specimens except those from Torquay, and these without fruit, which, so far as we are aware, has not been found on

British specimens. It is said to grow in similar localities to those of *C. rubrum*, which it very closely resembles, differing chiefly in its rather smaller size, and in the coloured cellules extending through only a part of the articulation, leaving a narrow pellucid band in the middle of each, about one-fourth or one-fifth of its length.

From all the other naked species of the genus, it may be readily known by its robust stems, except from *C. diaphanum*, and from that species it may be readily distinguished by the coloured cellules occupying the greater portion of the articulation, whereas in *C. diaphanum* they are confined to the dissepiment.

The *Hormoceras decurrens* of Kützing's *Phyc. Gen.* seems to be a much smaller plant, but in other respects agrees very well with Torquay specimens (see *Phyc. Brit.*).

We have frequently gathered, and often received from correspondents a variety or rather a state of *C. rubrum* as *C. decurrens*. To us this appears to be merely the ordinary form of *C. rubrum* in a state of incipient decay; the middle cellules of the articulation first losing their colouring matter, become transparent, while those at the dissepiment having it more condensed and more permanent, remain coloured, leaving a pellucid band in the middle of the articulation, in which, however, the empty cellules may by a careful inspection be readily observed.

CERAMIUM DECURRENS.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Apex of a branch.
2.—Longitudinal section from the middle of a branch.
3.—Articulations from same place.—*Phyc. Brit.* All magnified.

# Plate CI.

## CERAMIUM DESLONGCHAMPII.—*Chauv.*

Gen. Char.—Frond filiform, single tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *Deslongchampii*.—Frond filiform, cylindrical, attenuated at the summit, much branched in a very irregularly dichotomous manner, the apices mostly forked, straight, acuminate; articulations two to three times longer than broad in the main stems, very short upwards, those of the apices scarcely apparent. Favellæ lateral on the upper ramuli, with one to three involucral spines; tetraspores scarcely immersed, forming a ring round the dissepiment.

Ceramium *Deslongchampii*.—*Chauv.* in *Alg. Norm.*; *J. Ag. Advers.* p. 26; *Wyatt, Alg. Danm.* No. 218; *Hook. et Harv.* in *Lond. Journ. Bot.* vol. vi. p. 410; *Harv. P. B.* plate 219; *Harv. Man.* p. 162; *Harv. Syn.* p. 132; *Atlas*, plate 52, fig. 236; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 122.

Ceramium *Agardhianum*.—*Griff.* in *Harv. Man.* 1st ed. p. 99.

Gongroceras *Deslongchampii*.—*Kütz.* in *Linn.* xv. p. 735; *Phyc. Gen.* p. 379, t. 46, fig. 1.

Hab.—On stones, shells, rocks and smaller Algæ, generally between tide-marks. Annual. Spring, summer, and early autumn. Not uncommon around all the British coasts.

Geogr. Dist.—Coasts of France, Heligoland (*Binder*); Tasmania (*Gunn.*).

Description.—Root, a minute disc, with frequently long transparent jointed fibres. Fronds densely tufted, two to four inches long, and about one-eighth of a line in diameter, much branched in a very irregular manner, sometimes dichotomous, more frequently secund, occasionally subpinnate; main branches cylindrical, ramuli acuminate, simple or forked, scarcely incurved; articulations at the base about half as long as broad, about the middle two to three times longer than broad, but rather irregular, shorter upwards until lost in the apices; dissepiments and internodes equal, the latter often suffused with a deep but trans-

parent purple. Favellæ lateral or subterminal, rather large, with two to three involucral spines. Tetraspores common, whorled round the dissepiments, scarcely immersed, very prominent, roundish, tripartite. Substance rather firm, somewhat cartilaginous, and not very perfectly adhering to paper. Colour, dark purple, almost black in the mass, the pellucid articulations only becoming apparent when seen through a magnifier.

This beautiful species seems by no means rare on the British shores, growing on rocks, corallines, and the smaller Algæ, and frequently forms a dense dark, almost black curtain on the perpendicular sides of shaded rocks, looking very much both there and on paper like braided ringlets of black hair.

From *C. diaphanum* it is readily distinguished by its much more slender cylindrical stems, very dark colour, short articulations, and straight, not incurved apices. The same characters will also separate it from *C. decurrens*, together with the peculiar arrangement of the coloured cellules in that species.

Tetraspores appear to be common, and are very prominent, surrounding the dissepiment like a string of beads loosely strung. Favellæ seem to be rather rare, as we have only met with them once; spurious favellæ are more frequent, such as are found on *C. Botryocarpum.* These, however, contain no true spores as in the other, and appear to be only a kind of warts or superfluous growth, and possibly have no other relation to the fructification than in appearance.

From the very dark colour, and the shortness of the articulations, except towards the middle, the present species, when its dark coloured fronds hang suspended from its native rocks, has much more the appearance of some of the fibrillose *Polysiphoniæ* than of any of its congeners, and we can still remember having gathered it the first time as *Polysiphonia fibrata*, and it was not till viewed in the light of the microscope that we became aware of our mistake.

There are some Algæ which, however plentiful among the neighbouring rocks, are rarely seen among rejectamenta on the beach, and the present species seems to be one of the number. We can well remember when the smallest fragment of *Phyllophora rubens* or *membranifolia* was quite a treasure to us, in our simple ignorance that in the neighbouring rock-pools these and many other real rarities were growing in greatest luxuriance. These plants, it may be presumed, are less exposed in their sheltered rock-pool to be torn from their native home by the angry surge, yet there are others less protected, and yet seldom find their way to the sandy beach. *C. acanthonotum* grows in abundance on the most exposed rocks, and yet is

seldom seen on the beach. The present species is less common but equally exposed, yet we never met with it among rejectamenta. These and many others seem, in their delicate and yielding stems, to possess a safeguard from the tempest, while others more stubborn and resisting are broken or torn up by the roots.

EXPLANATION OF PLATE CI.

Fig. 1.—*Ceramium Deslongchampii*, natural size.
2.—Ramulus with favellæ ?
3.—Ramulus with a favella.
4.—Ramulus with tetraspores.
5.—Joint from same, more magnified.
6.—Tetraspore from same. All magnified.

1

2

4

3

6

5

*CERAMIUM Deslongchampii, CHAUV.*

Nature Printed by Henry Bradbury.

# Plate CII.

## CERAMIUM DIAPHANUM.—*Roth.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *diaphanum.* — Frond rather stout, gradually attenuated towards the summit; main divisions mostly dichotomous, more or less beset with short, simple or dichotomously multifid ramuli; articulations of the main divisions three to four times as long as broad, of the ramuli much shorter than broad; favellæ terminal or lateral on the ramuli, involucrate; tetraspores immersed in the shallow joints.

Ceramium *diaphanum.*—*Roth, Cat. Bot.* vol. iii. p. 154; *Ag. Syn.* p. 61; *Hook. Fl. Scot.* part 2, p. 85; *Ag. Syst.* p. 133; *Ag. Sp. Alg.* vol. ii. p. 150; *Grev. Fl. Edin.* p. 310; *Wyatt, Alg. Danm.* No. 87; *J. Ag. Alg. Medit.* p. 81; *Endl.* 3rd Suppl. p. 27; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 336; *Harv.* in *Mack. Fl. Hib.* part 3, p. 210; *Harv. P. B.* plate 193; *Harv. Man.* p. 163; *Harv. Syn.* p. 132; *Atlas,* plate 52, fig. 237; *Harv. N. B. A.* part 2, p. 215; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 125.

Hormoceras *diaphanum.*—*Kütz. Phyc. Gen.* p. 378; *Kütz.* in *Linn.* vol. xv. p. 733.

Conferva *diaphana.*—*Lightf. Fl. Scot.* p. 996; *Fl. Dan.* t. 951; *Roth, Fl. Germ.* p. 525, and *Cat.* vol. ii. p. 226; *Dillw. Conf.* t. 38; *E. Bot.* t. 1742; *With.* vol. iv. p. 139.

Conferva *nodulosa.*—*Huds. Fl. Angl.* p. 600.

Boryna *diaphana.*—*Grat. Dict. Class.* t. 11; *Bory, Morée,* p. 77, No. 1797.

Hab.—Parasitical on the smaller Algæ in rock-pools between tide-marks. Annual. Summer. Not uncommon around all the British coasts.

Geogr. Dist.—Temperate; Atlantic and Pacific Oceans; Mediterranean and Black Seas (*Ag.*).

Description.—Root, a minute conical disc. Fronds much branched from near the base, three to six inches long, one-sixth of a line thick in the middle, attenuated at the base and at the points; main divisions mostly dichotomous, at length more or less irregular by means of the innovations, beset throughout with short, simple, forked or dichotomously

multifid ramuli, apices shortly forked, more or less incurved; articulations, near the middle, three to five times longer than broad, of the ramuli and apices two to three times broader than long; dissepiments considerably swollen. Substance rather flaccid, more or less adhering to paper in drying. Colour, a rather clear purplish red. Favellæ small, terminal or lateral on the ramuli, with two to four short involucral spines. Tetraspores wholly immersed in the swollen joints, very conspicuous, triparted.

This fine species has long been the lodestone around which, conglomerated as varieties, all the transparent jointed spineless *Ceramia* took refuge (several of which have now been clearly defined as distinct species). It is at once conspicuous among the filiform Algæ by its distinctly pellucid articulations and dark coloured swollen dissepiments, visible even to the naked eye; than the last species, its colour is much paler, its stems less cylindrical and much more swollen at the joints. Much assimilated in habit to *C. decurrens*, it may at once be known from that species by the narrow band of cellules across the dissepiment.

In the present state of our knowledge of the species we are unable to fix with certainty its geographical distribution, as other species are so often sent under the names *Ceramium strictum*, *ciliatum*, and even *acanthonatum*, for example. Judging from our own observation, we would be inclined to conclude that it was not a common plant on our shores, as we have only occasionally met with it. Its favourite habitat seems to be deep worn rock-pools, where it generally lives as a parasite on corallines or the smaller Algæ, and when well grown, forms a beautiful and very conspicuous object.

## EXPLANATION OF PLATE CII.

Fig. 1.—*Ceramium diaphanum*, natural size.
2.—Ramulus with favellæ.
3.—Same, more magnified.
4.—Ramulus with tetraspores.
5.—Joint from same, more magnified.
6.—Tetraspore from same. All magnified.

*CERAMIUM diaphanum, GRIFF. et HARV.*

Nature Printed by Henry Bradbury.

## CERAMIUM GRACILLIMUM.—*Griff. et Harv.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from κέραμος, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *gracillimum.* — Fronds cylindrical, very slender; main branches dichotomous, scarcely tapering upwards, everywhere beset with short dichotomously multifid ramuli; articulations of the main divisions five to six times as long as broad, of the ramuli many times shorter than broad; favellæ terminal on the ramuli, involucrate.

Ceramium *gracillimum.*—*Harv. P. B.* plate 206; *Harv. Man.* p. 163; *Harv. Syn.* p. 133; *Atlas*, plate 51, fig. 232; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 118.

Ceramium *flaccidum.*—*Harv.* in *Herb.*

Hormoceras *gracillimum.*—*Kütz.* in *Linn.* vol. xv. p. 733; *Kütz. Phyc. Gen.* p. 378.

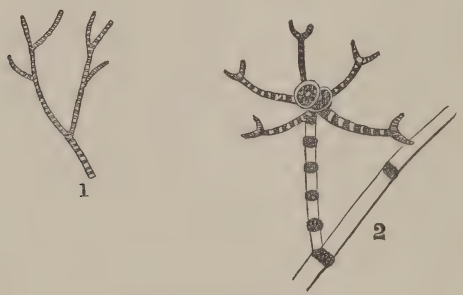
Hab.—On shells and the smaller Algæ at extreme low water. Annual. September. Kilkee, Coast of Clare (*Dr. Harvey*, 1844); Mewstone, Plymouth (*Rev. W. S. Hore* and *Dr. Cocks*); Penzance (*Mr. Ralfs*).

Geogr. Dist.—Mediterranean Sea; Atlantic coasts of France.

Description. — Fronds tufted, two to three inches long, and very slender, branched; main branches subdichotomous, of almost equal diameter throughout, rather distant and suberect, suddenly tapering at the summit, everywhere beset at the distance of one to three joints, with short many times dichotomous ramuli; apices forked and incurved. Articulations, near the middle, five or six times longer than broad, rather shorter upwards, those of the apices and ramuli very short, about twice as broad as long; dissepiments slightly swollen. Substance rather soft and flaccid, more or less adhering to paper. Colour, "a dark reddish purple."—*Phyc. Brit.* Favellæ terminal, on slender lateral branches, with three to four involucral spines, which are long, spreading, and frequently forked.

We have never met with this species on the east coast, and only know it from dried specimens, and these somewhat imperfect.

It may be readily known from the last species by the extreme tenuity of its filaments, all the divisions of which are of nearly equal diameter throughout, and by the minute flabelliform lateral branchlets. So slender are the filaments, that, when placed in water, they become almost invisible, the dark, dot-like dissepiments alone being apparent; the whole having the appearance of minute microscopic beads strung on invisible threads, and moving through the water. It is the most delicate of our native species of *Ceramium*, and when floating freely in its own native tide-pool, half invisible from its own transparency, it would be difficult to conceive a more beautiful object.




CERAMIUM GRACILLIMUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Apex of a ramulus.
2.—Ramulus with favellæ.—*Phyc. Brit.* Both magnified.

# Plate CIII.

## CERAMIUM STRICTUM.—*Kütz.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from κέραμος, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *strictum.*—Frond cylindrical, much branched from the base; main divisions dichotomous, long and very slender, straight and erect, all of nearly equal diameter throughout; apices forked, slightly incurved; articulations, towards the middle, three to four times longer than broad, rather shorter upwards, those of the apices about twice as broad as long; favellæ lateral, near the apices, involucrate; tetraspores whorled round the dissepiments, prominent.

Ceramium *strictum.*—*Harv. P. B.* plate 334; *Harv. Man.* p. 163; *Harv. Syn.* p. 134; *Atlas*, plate 51, fig. 233; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 123.

Gongroceras *strictum.*—*Kütz.* in *Linn.* 1842, p. 735; *Phyc. Gen.* p. 380; *Sp. Alg.* p. 678.

Hab.—On shells, corallines, &c. in tide-pools, near low-water mark. Torquay (*Mrs. Griffiths*); Penzance (*Mr. Ralfs*); Plymouth (*Mr. Boswarva* and *Dr. Cocks*); Jersey (*Miss Turner*); Dingle, Kerry (*Dr. Harvey*); Roundstone (*M'Calla*).

Geogr. Dist.—German Ocean (*Kütz.*).

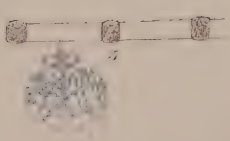
Description.—Root, a small disc, with minute fibres. Frond densely tufted, two to four inches long, extremely slender and cylindrical; main branches dichotomous, all of nearly equal diameter, without lateral ramuli, except here and there a short, simple, spine-like branchlet, long, erect, and straight; apices forked, straight, or slightly incurved; articulations, towards the middle, three to four times longer than broad, slightly shorter upwards, those of the ultimate ramuli very short, almost approximate, the dissepiments slightly swollen, those near the summit frequently copiously furnished, especially when young, with long, slender, flexible, pellucid hairs. Substance rather soft and flaccid, but very imperfectly adhering to paper. Colour, a fine purplish red, white in decay, when dry beautifully membranous and glossy. Favellæ lateral

on the upper branchlets, with two or three short spine-like involucral ramuli. Tetraspores tripartite, pale when young, deep red when mature, partially immersed in the upper ("not ultimate") branchlets, prominent, forming a beaded ring round the upper part of the dissepiment.

A very beautiful and delicate species, readily distinguished from the two preceding by the absence of the lateral ramuli, which are only represented by an occasional short, simple, curved, spine-like innovation. The extremely delicate hairs that abundantly clothe joints of young plants, are by no means peculiar to the species nor even to the genus, as they are common to most of the marine Algæ, and even to plants of a higher, or perhaps even of the highest organisation, they are perhaps nothing more than analogues of the pubescence that covers the young shoots of most plants, even of trees of the highest order, being perhaps meant as an additional protection to these tender parts in the earlier stages of their growth, disappearing as the parts become matured and require no such aid (?) They are much more abundant on the present than on any other species of the genus, and it is possible, as Professor Harvey observes, that they may be connected with the fructification, but their extreme delicacy, their simple structure, evanescent nature, and their being found the more sparingly down nearly to the middle of the plant, has always appeared to us to militate against that conclusion.

EXPLANATION OF PLATE CIII.

Fig. 1.—*Ceramium strictum*, natural size.
2.—Apex of ramulus.
3.—Ramulus with favella.
4.—Portion of same with tetraspores.
5.—Portion of stem. All magnified.



*Ceramium strictum*, Kütz.

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# Plate CIV.

## CERAMIUM NODOSUM.—*Griff. et Harv.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *nodosum.*—Frond rather rigid and brittle, extremely slender, and branched; branches irregularly dichotomous, often secund, and very patent, all of nearly equal diameter throughout; articulations, towards the middle, four to five times longer than broad, somewhat shorter upwards, those of forks very short; favellæ terminal on short lateral ramuli; tetraspores "erumpent from the outer edge of short accessory ramuli."

Ceramium *nodosum.*—*Harv. P. B.* plate 90; *Harv. Man.* p. 164; *Harv. Syn.* p. 134; *Atlas*, plate 51, fig. 234; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 121.

Hormoceras *nodosum.*—*Kütz.* in *Linn.* vol. xv. (1841) p. 732; *Kütz. Phyc. Gen.* p. 378, t. 45, fig. 1–7.

Ceramium *diaphanum*, rigid variety.—*Wyatt, Alg. Danm.* No. 217.

Ceramium *rigidulum.*—*Griff. & Harv.* in *Herb.*

Ceramium, new species.—*M'Calla, Alg. Hib.* vol. i. No. 43.

Hab.—On sandy shores, frequently at the roots of *Zostera*. Not uncommon.

Geogr. Dist.—Mediterranean Sea (*Kütz.*); New York (*Prof. Bailey*); Tasmania (*Gunn*).

Description.—Fronds densely tufted, two to four inches in length, very slender, capillaceo-multifid, all the divisions of nearly equal diameter and very patent, more or less regularly dichotomous; apices forked and incurved. Articulations towards the middle four to five times longer than broad, of the ultimate branchlets very short; dissepiments slightly swollen, those of the forks closely approximate. Substance rather "rigid and harsh to the touch when recent, soon becoming flaccid," adhering rather imperfectly to paper in drying. Colour, a rather pale brownish red. Favellæ terminal on short lateral proper branchlets, with one or

two very short involucral spines. Tetraspores scarcely immersed in the under side of similar branchlets.

A curious and interesting species, and one of the best marked and most satisfactory perhaps of this difficult genus, and well characterised by its peculiarly arranged tetraspores, and very patent branching. It has also, as Professor Harvey remarks, a peculiarly harsh and rigid feel, very unlike the other species of this section of the genus. The arrangement of the tetraspores is very peculiar, and strongly marks the species, being placed two or three together on the under side of slender, short, simple ramuli, and are so prominent that they may be said to be attached rather than immersed. The species seems to delight in the sandy or somewhat muddy shores of rather sheltered bays, and is perhaps not unfrequent, although few localities have been yet recorded, and these are chiefly confined to the Irish coast and the south and west of England.

Although not disposed to build a species, much less a genus on the presence or absence of a few evanescent hairs, yet we feel assured that several forms equally well marked as those already distinguished as species, may still reward the labours of the careful observer, in this rather puzzling but beautiful tribe of plants, and we would earnestly invite the attention of observers and collectors to a field likely to reward them with an abundant harvest.

EXPLANATION OF PLATE CIV.

Fig. 1.—*Ceramium nodosum*, natural size.
2.—Ramulus with favellæ.
3.—Ramulus with tetraspores. Both magnified.
(Reduced from *Phyc. Brit.*)

*CERAMIUM Nodosum*, GRIFF. and HARV.

Lithographed by Henry Bradbury

## CERAMIUM FASTIGIATUM.—*Harv.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *fastigiatum.*—Fronds densely tufted and corymbose, filaments much branched dichotomously; main divisions cylindrical, of equal diameter throughout, very erect, with acute axils, the apices shortly forked, and slightly incurved; articulations, towards the middle, four to six times longer than broad, gradually shorter upwards; favellæ subterminal, with two to four involucral spines.

Ceramium *fastigiatum.—Harv.* in *Hook. Lond. Journ. Bot.* vol. i. p. 303; *Harv. P. B.* plate 255; *Harv. Man.* p. 164; *Harv. Syn.* p. 135; *Atlas*, plate 51, fig. 235; *Harv. N. B. A.* part 2, p. 217; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 119; *Wyatt, Alg. Danm.* No. 86.

Gongroceras *fastigiatum.—Kütz.* in *Linn.* vol. xv. p. 736; *Phyc. Gen.*

Hab.—On rocks, shells, &c., near low-water mark. Rare. Annual. Autumn and winter. Torquay (*Mrs. Griffiths*); Plymouth (*Rev. W. S. Hore*); Frith of Forth (*Dr. Greville*).

Geogr. Dist.—Mediterranean Sea (*Kützing*); east coast of North America.

Description.—Fronds much tufted, corymbose, extremely slender and cylindrical, of equal diameter throughout, regularly dichotomous and flabellate, with very rarely a few distant, simple, or occasionally once or twice divided ramuli; the apices shortly forked, and scarcely incurved; branches distant below, gradually shorter upwards. Articulations at the middle four to five, or "six" times longer than broad, growing gradually shorter upwards, coloured, but without cells; the dissepiments slightly contracted or cylindrical. Substance "tender and flaccid, closely adhering to paper." Colour "in the tuft, a dark purple, fading to brick-dust colour in the herbarium." Favellæ near the extremity of the branchlets, furnished with two to four short involucral spines, formed by the metamorphosis of one of the segments of a fork (?).

With this species we are but very imperfectly acquainted, not having

met with the plant in a living state. From *C. nodosum* it seems abundantly distinct, both in habit and in fructification, and if the characters are constant, there will be no great difficulty in distinguishing the two, but from *C. strictum* we fear it will not be so easy to separate it; the principal differences seem to be the habit, a slight difference in the fructifications, and the colour of the internodes. This last character is not peculiar to the species, as it is frequent also in *C. acanthonotum*, and other species; and when viewed through the microscope, adds very much to the beauty of the filaments.

CERAMIUM FASTIGIATUM.

EXPLANATION OF DISSECTIONS, &c.

Fig. 1.—Portion of a filament.
2.—Portion of a filament with favella.
3.—Articulation from lower portion of same. All magnified.
4.—Tuft of *C. fastigiatum*, half natural size.

# Plate CV.

## CERAMIUM FLABELLIGERUM.—*J. Ag.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from *κέραμος*, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *flabelligerum.*—Fronds rather stout, much branched, the main divisions irregularly dichotomous, flabelliform, gradually attenuated upwards, with short lateral, simple, or forked ramuli; articulations entirely pervaded by coloured cells, those of the main branches once and a-half to twice as long as broad, the upper rather shorter, each with a short spine on its outer and upper edge; favellæ "two- to three-lobed," sessile on the upper branchlets, with three to four long patent involucral ramuli; tetraspores prominent, scarcely immersed in the joints of the upper branches.

Ceramium *flabelligerum.*—*J. Ag. Advers.* 27; *Harv. B. P.* plate 144; *Harv. Man.* p. 165; *Harv. Syn.* p. 135; *Atlas*, plate 52, fig. 238; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 134.

Hab.—Parasitical on the smaller Algæ, between tide-marks. Annual. Summer and autumn. Rare? Torbay (*Mrs. Griffiths*); Jersey (*Miss White, Mr. F. P. Girdlestone, Miss Edgar*).

Geogr. Dist.—South of England; coast of Spain.

Description.—Fronds densely tufted, two to three inches long, rather stout at the base, gradually attenuated upwards; the main divisions mostly dichotomous, frequently secund, erect or erecto-patent, somewhat distichous and flabelliform, more or less furnished with short, simple, or once or rarely twice divided ramuli, attenuated at the base, and somewhat curved; the apices acuminate, apices of the branches forked, the segments straight or very slightly curved. Articulations of the lower part of the frond once and a-half or twice as long as broad, slightly shorter upwards, those of the forks about as long as broad, entirely pervaded by coloured cellules, and having at the upper and outer angle of each a minute coloured three-jointed spine, slightly contracted at the dissepiments. Substance rather rigid and cartilaginous,

scarcely adhering to the paper in drying. Colour, a dark rather dull purplish red. Favellæ lateral on the upper branches, with an involucre of two to four ramuli, three to four times as long as the favellæ, coloured, spinous, and attenuated at the base like those on the branches; the favellæ two or three together, or "two- to three-lobed." Tetraspores large, scarcely immersed in joints of the upper branches.

The present species closely resembles in habit small specimens of *C. rubrum*, and has no very distant resemblance in the mass to *Rhodomela subfusca*, from both of which, however, its microscopic characters are abundantly distinct. From the former species it is readily known by its smaller size, more slender and numerous ramuli, and the minute but distinct spines; the latter character, and the coloured cells pervading the whole of the articulation, readily distinguish it from all the preceding species.

The south and west of England, and one or two stations on the Irish coast, are the only habitats of which we have heard, but it is not unlikely that it may be found far from uncommon when better known to observers in other parts of the country.

EXPLANATION OF PLATE CV.

Fig. 1.—*Ceramium flabelligerum*, natural size.
2.—Apex of a branch.
3.—Ramulus with favella.
4.—Portion of a ramulus with tetraspores.
5.—Tetraspore from same. All magnified.

*Ceramium flabelligerum. J. Ag.*

Nature Printed by Henry Bradbury.

# Plate CVI.

## CERAMIUM ECHIONOTUM.—*J. Ag.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from κέραμος, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *echionotum.* — Fronds cylindrical, of equal diameter throughout, much branched dichotomously; branches erect, apices forked and involute; articulations, towards the middle, three to four times longer than broad, gradually shorter upwards; dissepiments slightly swollen, beset with scattered, squarrose, pellucid, single-jointed spines; favellæ lateral near the apices of the branches, with several (four to five) incurved involucral spines; tetraspores very prominent, one or two on the outer margin of the ramulus.

Ceramium *echionotum.*—*J. Ag. Advers.* p. 27; *Harv. P. B.* plate 141; *Harv. Man.* p. 165; *Harv. Syn.* p. 135; *Atlas*, plate 52, fig. 239; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 131.

Hab.—On rocks, stones, shells, &c., between tide-marks and in rock-pools, on other Algæ. Annual. Summer and autumn. Not uncommon.

Geogr. Dist.—Atlantic and Mediterranean coasts of Europe.

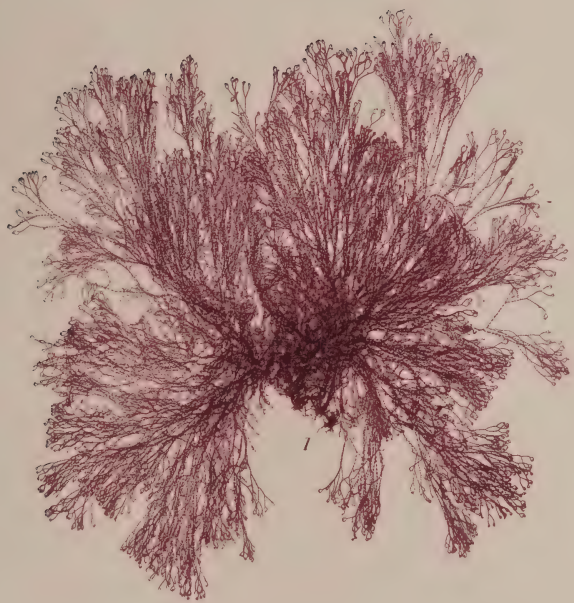
Description.— Fronds very densely tufted, slender and cylindrical, three to four or "six" inches long, very much branched; branches dichotomous, erect, subfastigiate, without lateral branchlets, or with few scattered, simple or forked ramuli, apices forked and incurved. Articulations, below the middle, three to four times longer than broad, gradually shorter upwards, those of the apices very short, pellucid; dissepiments opaque, slightly swollen, beset with short fusiform, pellucid, scattered, squarrose spines, much attenuated at their base, and single-jointed. Substance somewhat rigid, and not very perfectly adhering to paper. Colour, a more or less deep purplish red. Favellæ lateral or axillary on the upper ramuli, one or two together, or one- or two-lobed, with four to five strongly incurved involucral spines, twice as long as the favellæ. Tetraspores mostly solitary or rarely two together, very

prominent, about half immersed in the outer edge of the dissepiments of the upper forks.

This species is readily distinguished from the preceding by the absence of coloured cells from the greater portion of the articulation, and by the pellucid, three-jointed spines, scattered all round the dissepiment, and pointing in every direction. It does not seem to be at all a scarce species, but from its being so often confounded with *C. ciliatum* and other species, it is not easy to ascertain with anything like certainty its true geographical range. Its nearest affinity seems to be *C. ciliatum*, from which it may be at once known by the single-jointed spines pointing in every direction, and scattered all over the dissepiment, whilst in that species they form a regular whorl round the middle, and mostly point upwards. The fact of its being so often confounded with other closely allied species, we do not consider so much depending on the inaccuracy of observers as on their being led, by following the older writers, to consider them all as only forms of one variable species.

EXPLANATION OF PLATE CVI.

Fig. 1.—*Ceramium echionotum*, natural size.
2.—Apex of a branch.
3.—Joints with tetraspores.
4.—A tetraspore from same.
5.—Favellæ. All magnified.



*Ceramium echionotum, J. Ag.*

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# Plate CVII.

## CERAMIUM ACANTHONOTUM.—*Carm.*

Gen. Char.—Frond filiform, single-tubed, articulated ; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants : 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli ; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from κέραμος, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *acanthonotum.*—Fronds densely tufted, much branched ; branches dichotomous, fastigiate ; articulations, towards the middle, three to five times longer than broad, very short upwards, without coloured cells ; the dissepiments each with a stout, coloured, erect, three-jointed spine, projecting upwards from its outer edge, closely approximate in the apices, which are forked and strongly involute ; favellæ in the axil of a short incurved involucral spine ; tetraspores very prominent, closely whorled round the dissepiments of the upper branches.

Ceramium *acanthonotum.—Carm. Alg. Appin,* ined. cum ic. ; *J. Ag. Advers.* p. 26 ; *Harv. P. B.* plate 140 ; *Harv. Man.* p. 165 ; *Harv. Syn.* p. 136 ; *Atlas,* plate 52, fig. 240 ; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 132.

Ceramium *ciliatum, β acanthonotum.—Harv.* in *Hook. Br. Fl.* vol. ii. p. 336 ; *Harv. Man.* 1st ed. p. 100.

Acanthoceras *Shuttleworthianum.—Kütz.* in *Linn.* vol. xv. p. 739 ; *Kütz. Phyc. Gen.* p. 381, t. 46, f. 4.

Hab.—On rocks, shells, stones, and smaller Algæ, near low-water mark. Annual. Summer and autumn. Common.

Geogr. Dist.—British Islands ?

Description. — Root fibrous. Fronds densely tufted, often forming hemispherical tufts, very much entangled, and much divided dichotomously, without or occasionally with lateral ramuli ; branches of nearly equal diameter throughout, and very slender, the apices forked and strongly involute ; plants one to three or even "six" inches in length, the smaller specimens very much matted and interwoven, the larger more loose and free. Articulations variable, towards the middle three to five or even six times longer than broad, shorter upwards till lost in the apices, without coloured cells ; the dissepiments opaque, and

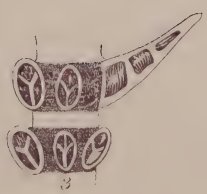
slightly swollen, with a strong conical, coloured, three jointed spine projecting upwards from its outer edge, its base hardly reaching to the lower edge of the dissepiment. Substance rather rigid, and not very tenaciously, at least in the older parts, adhering to paper. Colour, a dark purplish red, fading to a pale red or reddish white in decay. Favellæ roundish, single, lateral on the upper branchlets, with a single involucral spine, strongly involute, about one and a-half times the diameter of the favellæ.

A beautiful and definite, although one of our most common species; scarcely less common on the east coast than *C. rubrum*, nor is it less omnicolous in its habitat, growing from high-water mark almost to the lowest level of spring-tides; on rocks only covered for a short time at high-water, as well as in tide-pools where it is never dry, and on stones, old shells, and frequently parasitical on the smaller Algæ. When found on rocks, however, it more frequently grows on the shells that generally cover it than on the rock itself.

On the east coast in many places, where it grows in great profusion on rocks covered with mussel-shells and barnacles, near high-water mark, it forms dense hemispherical tufts, from one to two inches in diameter; but on sand-covered rocks it grows parasitically in equal abundance and much greater luxuriance, often from three to five inches in length. In shady tide-pools it often attaches itself to *Corallina* and other Algæ. The larger specimens may be readily mistaken for *C. strictum*, but the lateral spines will readily distinguish them. In these it very closely resembles *C. flagelliferum*, but the habit, slender filaments, and transparent articulations will at once separate it from that species; while its single, erect, robust, three-jointed, coloured spines will be easily distinguished from the numerous pellucid, single-jointed, squarrose spines of *C. echionotum*. The favellæ and tetraspores when present, and they are not rare, will afford additional characters.

EXPLANATION OF PLATE CVII.

Fig. 1.—*Ceramium acanthonotum*, natural size.
2.—Apex of a branch.
3.—Joints with tetraspores.
4.—Tetraspore from same.
5.—Branchlet with favellæ. All magnified.



*Ceramium acanthonotum*, C.A.R.M.

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# Plate CVIII.

## CERAMIUM CILIATUM.—*Ducluz.*

Gen. Char.—Frond filiform, single-tubed, articulated; joints, and occasionally more or less of the articulation, pervaded by coloured cells. Fructification of two kinds, on distinct plants: 1. Favellæ, roundish, with a pellucid limbus, and generally surrounded at the base by an involucre of few short articulated spine-like ramuli; 2. Tetraspores, more or less immersed in the ultimate ramuli. Name from κέραμος, "a pitcher;" but the name is not applicable to the fruit of any species of the genus as now restricted.

Ceramium *ciliatum.* — Fronds much tufted, filaments slender, cylindrical, all the branches of nearly equal diameter, apices forked, strongly involute; articulations, towards the middle, three to four times longer than broad, very short upwards, pellucid; the dissepiments opaque, with a whorl of stout, short, three-jointed spines round the middle; favellæ "lateral, with two or three involucral ramuli;" "tetraspores alternating with the spines."

Ceramium *ciliatum.*—*Ducluz. Ess.* p. 64; *Lyngb. Hyd. Dan.* p. 121, t. 37; *Ag. Sp. Alg.* vol. ii. p. 153; *Hook. Fl. Scot.* part 2, p. 14; *Grev. Fl. Edin.* p. 311; *Wyatt, Alg. Danm.* No. 180; *J. Ag. Alg. Medit.* p. 81; *J. Ag. Advers.* p. 26; *Mont. Fl. Algier.* p. 145; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 336; *Harv.* in *Mack. Fl. Hib.* part 3, p. 211; *Harv. P. B.* plate 139; *Harv. Man.* p. 166; *Harv. Syn.* p. 137; *Atlas*, plate 52, fig. 241; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 133.

Ceramium *diaphanum*, var. *ciliatum.*—*Duby, Bot. Gall.* p. 967; *Ag. Syst.* p. 134.

Echinoceras *ciliatum.*—*Kütz.* in *Linn.* vol. xv. p. 736; *Kütz. Phyc. Gen.* p. 380.

Borvna *ciliata.*—*Gratel. Bory, Dict. Class. Fl. Pelop.* p. 77.

Conferva *ciliata.*—*Ellis, Phil. Trans.* vol. lvii. p. 425, t. 18, fig. h, H.; *Huds. Fl. Angl.* p. 599; *Lightf. Fl. Scot.* p. 998; *With. Br. Pl.* vol. iv. p. 137; *Dillw. Conf.* p. 77, t. 53; *E. Bot.* t. 2428.

Conferva *pilosa.*—*Roth, Cat. Bot.* vol. ii. p. 225, t. 5, f. 2.

Hab.—On rocks, stones, shells, corallines, and the smaller Algæ in the sea; also in tide-pools exposed at low water. Annual. Summer. Common.

Geogr. Dist.—In temperate latitudes of the Atlantic and Pacific Oceans.

Description.—Fronds densely tufted, two to four inches in length, much branched; branches slender, dichotomous, of nearly equal diameter throughout, erect, rather rigid, without lateral ramuli, or occasionally with few simple or more or less dichotomously divided ramuli, apices forked,

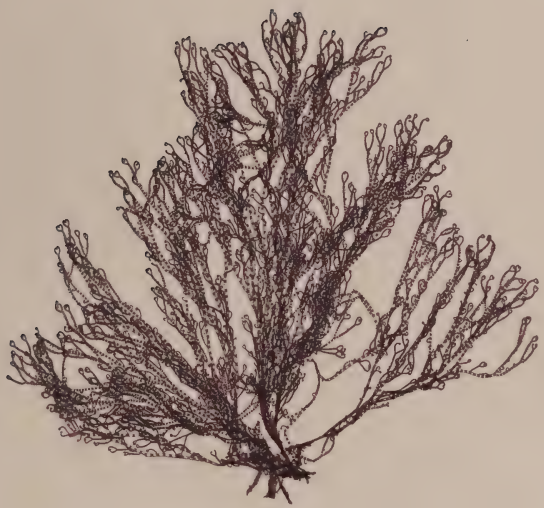
strongly involute. Articulations pellucid, below the middle three to four times longer than broad, very short upwards, those in the apices scarcely apparent; dissepiments opaque, scarcely swollen, furnished in the middle with a whorl of from six to eight stout, pellucid, three-jointed spines, all regularly pointing upwards, the two upper joints very small, the basal one very large and contracted at the base. Substance rather rigid, very imperfectly adhering to paper in drying. Colour, a rather dark purplish red, soon changing to pale reddish purple and reddish white in decay. Favellæ "roundish, lateral, nearly sessile, and accompanied by three or four short, incurved ramuli."—*Dillwyn* in *Phyc. Brit.* Tetraspores "not very prominent, disposed in a whorl round the joint, alternately with the prickles."—*Phyc. Brit.* Both seem to be rare, as we have seen neither.

The name of the present species has long formed a receptacle for the greater part of the ciliated and even spinous species of *Ceramia*, several of which are now pretty clearly distinguished as species. From *C. echionotum* it is readily known by its regular whorl of erect, three-jointed, not scattered, squarrose, single-jointed spines, and from *C. acanthonotum* by the single erect spine on each of the dissepiments of that species. The habit of the three species is much the same, as well as that of *C. strictum* and *nodosum*; they have therefore been denominated "cabinet" species, as their characters are not readily apparent to the naked eye, and only become perceptible when submitted to the analysing powers of the microscope.

The present species does not seem to be abundant in many places, as we have rarely met with it, and never in plenty, and few of our correspondents seem well acquainted with it. Both kinds of fruit appear to be rare.

EXPLANATION OF PLATE CVIII.

Fig. 1.—*Ceramium ciliatum*, natural size.
2.—Apex of a branch.
3.—Joint with tetraspores.
4.—A tetraspore from same.
5.—Joint with ciliæ. All magnified.



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CERAMIUM ciliatum, DUCLUZ.

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## DUDRESNAIA COCCINEA.—*Bonnem.*

Gen. Char.—Frond very tender and gelatinous, composed of two strata of filaments forming a cylindrical frond; axis consisting of one or more longitudinal articulated filaments, producing at their joints whorls of dichotomously multifid vertical ramuli. Fructification of two kinds, on distinct plants: 1. Favellidia, produced at the base of the ramuli; 2. Tetraspores, transversely quadripartite, terminal at their apices. Name in honour of M. Dudresnay.

Dudresnaia *coccinea.* — Frond filiform, very flaccid, much branched; branches irregular, somewhat alternate, patent or erecto-patent; whorls of ramuli at first moniliform, at length approximate.

Dudresnaia *coccinea.*—*Bonnem.* in *Journ. Phys.* vol. xciv. p. 180; *Crouan, Nouv. An. Sc. Nat.* vol. iii. p. 98, t. 2, f. 3—4; *J. Ag. Alg. Medit.* p. 84; *Endl.* 3rd Suppl. p. 37; *Harv. P. B.* plate 244; *Harv. Man.* p. 154; *Harv. Syn.* p. 127; *Atlas*, plate 49, fig. 220; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 108.

Mesogloia *coccinea.*—*Ag. Syst.* p. 51; *Hook. Br. Fl.* vol. ii. p. 386; *Wyatt, Alg. Danm.* No. 148; *Harv.* in *Mack. Fl. Hib.* part 3, p. 186; *Harv. Man.* 1st ed. p. 48.

Rivularia *verticillata.*—*E. Bot.* t. 2466.

Hab.—On rocks, &c., near low-water mark; and in three to twelve fathoms water. Annual. Summer. Very rare. Brighton (*Mr. Borrer*); Sidmouth and Torquay (*Mrs. Griffiths* and *Miss Cutler*); Salcombe (*Mrs. Wyatt*); Plymouth (*Rev. W. S. Hore*); Falmouth (*Miss Warren*); Jersey (*Misses White* and *Turner*); Bantry Bay (*Miss Hutchins*); Arran (*Mr. D. Landsborough*); near Dunbar (*Mrs. R. M. Stark*).

Geogr. Dist.—Atlantic coasts of France.

Description.—Root, a minute conical disc. Frond attenuated at the base, filiform, four to six or "ten" inches long, about a line in thickness —including the whorls,—much branched from near the base; branches irregular,mostly alternate, upper ones very short, patent or erecto-patent; the axils rounded, the apices obtuse. Structure: when young composed of a simple, articulated, longitudinal filament, emitting at the joints dense whorls of short, vertical, dichotomously multifid ramuli; at length, by the superposition of other filaments of a similar structure, each with its whorl of ramuli, the whorls become so close as to form a close stratum of vertical filaments, constituting the periphery of the frond. Substance very soft and gelatinous, soon decomposing, adhering tenaciously to paper in drying. Colour, a brilliant crimson when fresh, reddish brown when dry, dirty white in decay. Favellidia formed at the base of the vertical ramuli. Tetraspores oblong, terminal at their apices.

This interesting plant is one of the rarest as well as the most beautiful of our native Algæ. An inhabitant of deep water, it is never met with

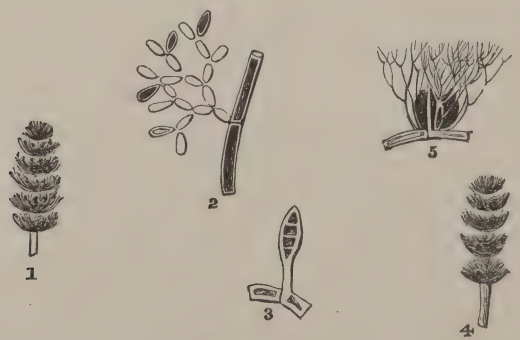
except in the dredge or on the beach, and in the latter case we are assured that a great part of its beauty has vanished before it is seen, and that it is only when fresh from its native deep that the brilliancy of its colours, and even the perfection of its structure, can be enjoyed. Even in its native home it seems to be little less a rarity, or perhaps it delights in the deep recesses of the ocean's caves, far removed from the strife and turmoil of the tempest; and only a stray specimen, torn perchance from a more exposed site before it has reached maturity, will reach the shore or come within the dredger's grasp. Be that as it may, it seldom falls into the collector's hands, and fine specimens in good condition are always looked upon as a prize.

So tender and delicate is the plant, that it very rapidly decomposes, even in salt water, after being gathered, and if once pressed and removed from the paper, it presents nothing but a confused mass of gelatine, broken cells and spores, the last only preserving their form and colour.

To Miss Warren, and other southern friends, we feel deeply indebted for specimens of this and other rare species.

We have seen no Irish specimens, and are not aware of its recent occurrence there. On the south and south-west of England it is of more frequent occurrence, but its appearance is uncertain.

When fresh, and in fruit, a more beautiful object under the microscope could scarcely be conceived; the bright but transparent tint of the articulated branchlets, dotted over with the still deeper colour of the abundant fructification, form a really beautiful object; but so delicate is its structure, that when placed in fresh water, the cells burst and the colour disperses, even before the eye of the observer.




DUDRESNAIA COCCINEA.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet with tetraspores.—2. Ramulus from whorls.—3. Tetraspore from same.—4. Branchlet with favellæ.—5. Ramuli with same from a whorl. All magnified.

# Plate CIX.

## CROUANIA ATTENUATA.—*J. Ag.*

Gen. Char.—Frond gelatinous, cylindrical, moniliform, consisting of a single-jointed tube, emitting at the joints dense whorls of short dichotomously multifid ramuli. Fructification of two kinds, on distinct plants: 1. "Favellidia, subsolitary near the apex of the ramuli, affixed to the base of the whorled ramelli, and covered by them, containing, within a hyaline membranous perispore, a subglobose mass of minute spores;" 2. Obovate tetraspores, produced near the base of the ramuli. Name in honour of the brothers Crouan of Brest.

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Crouania *attenuata.—J. Ag. Alg. Medit.* p. 83; *Endl.* 3rd Suppl. p. 36; *Harv. P. B.* plate 106; *Harv. Man.* p. 155; *Harv. Syn.* p. 128; *Atlas*, plate 50, fig. 229; *Harv. N. B. A.* part 2, p. 226; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 105.

Mesogloia *attenuata.—Ag. Syst.* p. 51.

Mesogloia *moniliformis.—Griff.* in *Wyatt, Alg. Danm.* No. 197; *Harv. Man.* 1st ed. p. 49.

Griffithsia *nodulosa.—Ag. Sp. Alg.* vol. ii. p. 136.

Callithamnion *nodulosum.—Kütz. Phyc. Gen.* p. 373.

Batrachospermum *attenuatum.—Bonnem.*

Hab.—Parasitical on the smaller Algæ, particularly *Cladostephus spongiosus*. Annual. Summer. Very rare. Salcombe Bay (*Mrs. Wyatt*); Mousehole near Penzance (*Mr. Ralfs*); Plymouth (*Dr. Cocks*).

Geogr. Dist.—Mediterranean and Adriatic Seas; Atlantic coasts of France. Very rare, as above.

Description.—Root, a minute disc. Fronds tufted, parasitical, from half an inch to one and a-half or two inches in length, much branched in an alternately pinnated manner; branches distant, cylindrical, and moniliform, attenuated at the points, erect or erecto-patent. Structure composed of a single cylindrical, articulated filament, the joints cylindrical, three to four times longer than broad near the base, gradually shorter upwards, emitting at each joint a dense whorl of multifid ramuli, the divisions of which are short, fastigiate, articulated, trichotomous at the base, dichotomous upwards at each joint. Substance gelatinous, and closely adhering to the paper in drying. Favellidia seem to be rare on British specimens, and we have never seen them. Tetraspores are common, and are produced near the base of the ramuli by the metamorphosis of one of the divisions, and are sessile, obovate, and triparted.

This lovely little "gem of the sea" is rare in this country, and scarcely less so on the shores of Continental Europe, and although no doubt often overlooked on account of its small size, is most likely of scarce occurrence, as it has not been observed in numerous places which have been carefully examined by celebrated collectors.

In structure, as well as in fructification, it is closely related to *Callithamnion*, the minor character in habit being almost the only one to separate it from that genus, with which some authors unite it.

Although its small size, and not very brilliant colour, render it by no means a very conspicuous object in a rock-pool, yet when growing parasitically, and in a mass, its delicate waving fronds form a most beautiful and interesting object; its dense whorls of ramuli give the fronds a beaded appearance, and render them more susceptible of motion from the slightest movement in the water; placed under the microscope, the beautifully beaded fronds, the numerous articulations on the little reddish brown globule of endochrome within its hyaline tube, form a very pretty object, and when dotted over with the dark coloured tetraspores, a more lovely object could hardly be conceived.

EXPLANATION OF PLATE CIX.

Fig. 1.—*Crouania attenuata*, natural size.
2.—Branchlet with whorled ramuli.
3.—Tetraspore from same.
4.—Ramulus from whorl. All magnified.

*Crouania attenuata, J. Ag.*

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# Plate CX.

## PTILOTA PLUMOSA.—*Ag.*

Gen. Char.—Frond linear, compressed or flat, distichously pectinato-pinnate, composed of two strata, an axis composed of a simple articulated tube, finally covered by a thick stratum of minute cells. Fructification of two kinds, on distinct plants: 1. Favellæ, furnished with an involucre; 2. Tetraspores, tripartite. Name from πτίλωτος, "pinnated."

Ptilota *plumosa*.—Fronds linear, compressed, irregularly branched; branches mostly tripinnate, pinnæ and pinnulæ opposite; favellæ stalked, involucrate, alternating with the pinnulæ; tetraspores stalked, fringing the margins of the pinnules.

Ptilota *plumosa*.—*Ag. Sp. Alg.* vol. i. p. 358 (excl. var. β); *Ag. Syst.* p. 195; *Lyngb. Hyd. Dan.* p. 38, t. 9; *Grev. Fl. Edin.* p. 297; *Spreng. Syst. Veg.* vol. iv. p. 344; *Hook. Fl. Scot.* part 2, p. 106; *Grev. Alg. Brit.* p. 155, t. 16; *Hook. Br. Fl.* vol. ii. p. 84; *Endl.* 3rd Suppl. p. 36; *Post. & Rupp.* p. 16; *Kütz. Phyc. Gen.* p. 378, t. 46, f. 6; *Harv.* in *Mack. Fl. Hib.* part 3, p. 204; *Harv. P. B.* plate 80; *Harv. Man.* p. 159; *Harv. Syn.* p. 129; *Atlas*, plate 49, fig. 223; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 95.

Ceramium *plumosum*.—*Roth, Cat. Bot.* vol. iii. p. 133; *Ag. Dist.* p. 17.

Plocamium *plumosum*.—*Lamour. Ess.* p. 50.

Fucus *plumosus*.—*Linn. Mant.* p. 134; *Syst. Nat.* vol. ii. p. 718; *Huds. Fl. Angl.* p. 587; *Gm. Hist. Fuc.* p. 152; *Fl. Dan.* t. 350; *Lightf. Fl. Scot.* vol. ii. p. 955; *With.* vol. iv. p. 120; *Esper, Ic. Fuc.* vol. i. p. 92, t. 45; *Fl. Norv.* vol. ii. p. 91; *Linn. Trans.* vol. iii. p. 188; *Turn. Syn. Fuc.* vol. ii. p. 296; *Turn. Hist. Fuc.* t. 60 (excl. var. β); *E. Bot.* t. 1308.

Hab.—Parasitical on the stems of *Laminariæ*. Perennial. Summer and autumn. Common on the shores of Scotland, and of the north and west of Ireland; Holyhead, gradually becoming scarcer as you proceed southwards, till it becomes rare, and eventually disappears.

Geogr. Dist.—Arctic, North Atlantic and North Pacific Oceans; Davis' Strait (*Turner*); Iceland (*Œder*); White Sea, Greenland, Sitka, Unalaska (*Postels* and *Rupprecht*); Arctic America (*Richardson*); Kamtschatka (*Bongard*); Norway and Sweden.

Description.—Root, a small conical disc. Fronds tufted or single, linear, compressed, two to four times irregularly divided from near the base, three to nine inches or even a foot in length, and from one-sixth to nearly a line in breadth; all the divisions, as well as the stem down to the base, closely pectinato-pinnate, with pinnate, bipinnate, tripinnate, or even quadripinnate ramuli, all very patent, and very closely set; the

ultimate ramuli short, linear, subulate, and so closely set that their slightly expanded bases touch each other, longest below the middle of the pinnule, giving it a lanceolate or ovato-lanceolate outline; all the divisions except the last are of very unequal length and ramification, one being scarcely a line in length, and scarcely pinnate, while the one by its side is two or even four inches long and tripinnate. Favellæ clustered at the apex of short stalks formed from metamorphosed abbreviated ramelli, with which they generally alternate, but not unfrequently the whole or most of the ramelli are fructiferous, and occasionally favellæ are produced on most of the ramuli, even down to the third or second series; the cluster is surrounded by from six to eight subulate involucral ramuli, about three times the length of the cluster. Tetraspores roundish, triparted, seated on minute pedicels which fringe the margin of slightly abbreviated pinnules. Structure consists of a single articulated thread, composed of joints rather longer than broad, surrounded with a thick stratum of minute cells, interspersed with others very large, ovate-oblong, all filled with granular endochrome, those at the surface coloured. Substance cartilaginous, generally adhering to paper in drying. Colour, a deep somewhat brownish red, changing to yellowish green in decay.

This beautiful Alga is one of the most common sea-weeds on the shores of Scotland, both on the east and west coasts. On the northern shores of England it is of less frequent occurrence, and becomes less and less common as we proceed southwards, and on the southern shores entirely disappears. Delighting in low temperatures, however, it extends the range of its habitat even to the shores of the Arctic Ocean, and is said to be equally abundant both in the North Atlantic and in the North Pacific, thus occupying a broad zone of latitude which encircles the world, only interrupted by the land and the depths of the ocean on either side.

It is curious and highly interesting to study the laws that regulate the distribution of plants. The distribution of land plants must always be circumscribed, and even of those less likely to be affected by any slight change of temperature, must proceed slowly; but that of sea-weeds should be under no such rigorous restraint, yet it seems regulated by laws as strict and unvarying. Why should not the present species be found on our southern as well as on our northern shores? The chalk cliffs of England cannot deter it, as it lacks the wisdom of the wise man to fix its home upon the rock; the stems of *Laminaria digitata*, its chosen habitat, are not wanting even on the shores of France and Spain, and its spores must be often carried by the tide as far, and scattered in myriads on these distant shores, yet there they have ceased

to vegetate, or at least to find a home. In the south of England, and on the shores of France and Spain, its place is supplied by the following species, and farther south by others, which, though closely allied, are abundantly distinct.

EXPLANATION OF PLATE CX.

Fig. 1.—*Ptilota plumosa,* natural size.
2.—An involucre.
3.—Favellæ from same.
4.—Portion of lacinia with tetraspores.
5.—A tetraspore from same. All magnified.

*Ptilota plumosa*, *Ag.*

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# Plate CXI.

## PTILOTA ELEGANS.—*Kütz.*

Gen. Char.—Frond linear, compressed or flat, distichously pectinato-pinnate, composed of two strata, an axis composed of a simple articulated tube, finally covered by a thick stratum of minute cells. Fructification of two kinds, on distinct plants: 1. Favellæ, furnished with an involucre; 2. Tetraspores, tripartite. Name from πτίλωτος, "pinnated."

Ptilota *sericeus.*—Frond very flaccid, much and irregularly branched, primary divisions having the axis covered with a coating of cells; pinnæ and pinnulæ consisting of the articulated axis; favellæ in pairs, with or without involucral ramuli.

Ptilota *elegans.—Kütz. Phyc. Gen.* p. 378; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 94.

Ptilota *plumosa*, var. γ *tenuissima.—Ag. Sp. Alg.* vol. i. p. 386; *Ag. Syst.* p. 195.

Ptilota *plumosa*, β *capillaris.—Grev. Alg. Brit.* p. 155; *Hook. Br. Fl.* vol. ii. p. 307; *Wyatt, Alg. Danm.* No. 77; *Harv.* in *Mack. Fl. Hib.* part 3, p. 204; *Harv. Man.* 1st edit. p. 84.

Ptilota *sericea.—Gmel.*; *Harv. P. B.* plate 191; *Harv. Man.* p. 160; *Harv. Syn.* p. 129; *Atlas*, plate 49, fig. 222.

Fucus *sericeus.—Gm. Hist. Fuc.* p. 149, t. 15, f. 3.

Fucus *Ptilotus.—Gunn. Fl. Norv.* vol. ii. p. 135, t. 2, f. 15; *Esper, Ic.* p. 96, t. 46.

Fucus *pectinatus.—Gunn. Fl. Norv.* vol. ii. p. 122, t. 2, f. 8; *Esper, Ic.* p. 97, t. 47.

Plocamium *elegans.—Bory*, sec. *Kütz.*

Hab.—On the faces of perpendicular rocks between tide-marks; sometimes on Fuci. Perennial. Summer and autumn. Common on the British shores.

Geogr. Dist.—Atlantic shores of Europe; east coast of North America.

Description.—Root, a small conical disc. Frond linear, compressed, tufted, three to eight inches long, one quarter of a line in breadth, much branched from near the base; branches irregular, mostly alternate, erecto-patent, two to four times pinnated; pinnæ, and especially the pinnulæ, very patent and filiform, all very irregular in length, except the ultimate divisions, which are longest above or below the middle, giving the ramulus an ovate or lanceolate outline, all the divisions pectinato-pinnate and distichous, the older often more or less tomentose, with short, simple ramuli. Structure consisting of a central, simple,

articulated axis of oblong cells, ultimately covered, at least in the older parts, with a stratum of minute cells, interspersed with one or two series of large, angular, oblong ones, the younger parts composed only of the central articulated axis. Substance very flaccid, scarcely cartilaginous, rather firmly adhering to paper. Colour, a very dark dull brownish red, almost black in the mass. Favellæ terminal on short, abbreviated ramuli, roundish ovate, in pairs, generally with one to four short involucral ramuli, shorter than the favellæ. Tetraspores on short, mostly single-jointed stalks or ramuli, roundish, with a wide hyaline limbus.

The present species is certainly very closely allied to the preceding, both in structure, habit, and fructification; yet we have no hesitation in agreeing with Professor Harvey in keeping it distinct, believing that the characters are quite sufficient to justify us in so doing. From that species it may be readily distinguished by the ramuli wanting the cellular covering that spreads over the main divisions of the frond; this coating is at first composed of a single stratum of cellules, through which the articulated axis may be readily perceived, but as the plant advances in age, the cellular coating extends upwards, and becomes so much thickened, that the axis cannot be seen through it, and is even sometimes partially obliterated, and the stem, like that of *Dasya coccinea*, becomes very much beset on all sides with very short, simple, articulated ramuli. Its favourite habitat is under the shade of overhanging rocks, where it often grows in broad patches, lying procumbent on the rock when the tide has retired, or hanging in dark curtains from the projecting angles, each festoon tipped with a brilliant drop of amber-coloured water, and feeling to the touch like the realisation of the silken tassels gemmed with gold and brilliants of the mermaid's halls.

EXPLANATION OF PLATE CXI.

Fig. 1.—*Ptilota elegans*, natural size.
2.—Part of pinnule.
3.—Part of pinnule with tetraspores.
4.—Part of pinnule with favellæ.
5.—A tetraspore.
6.—Portion of stem. All magnified.

*Ptilota elegans*, Kütz.

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# Plate CXII.

## GRIFFITHSIA EQUISETIFOLIA.—*Ag.*

Gen. Char.—"Frond rose-red, filamentous; filaments jointed throughout, mostly dichotomous; ramuli single-tubed; dissepiments hyaline." Fructification of two kinds, on distinct plants: 1. Favellæ, surrounded by an involucre; 2. Tetraspores, attached to whorled "involucral ramuli." Name in honour of Mrs. Griffiths, well known for her numerous and valuable discoveries among British Algæ.

Griffithsia *equisetifolia.*—Stems rather stout; ramuli whorled, at length closely imbricated, incurved, dichotomous, receptacles of the tetraspores stalked; favellæ terminal on abbreviated ramuli.

Griffithsia *equisetifolia.*—*Ag. Syn.* p. 28; *Hook. Fl. Scot.* part 2, p. 84; *Ag. Syst.* p. 143; *Grev. Fl. Edin.* p. 312; *Ag. Sp. Alg.* vol. ii. p. 133; *Hook. Br. Fl.* vol. ii. p. 337; *Wyatt, Alg. Danm.* No. 181; *J. Ag. Alg. Medit.* p. 78; *Endl.* 3rd Suppl. p. 35; *Harv.* in *Mack. Fl. Hib.* part 3, p. 211; *Harv. P. B.* plate 67; *Harv. Man.* p. 167; *Harv. Syn.* p. 138; *Atlas*, plate 53, fig. 245.

Halurus *equisetifolius.*—*Kütz. Phyc. Gen.* p. 374; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 90.

Conferva *equisetifolia.*—*Lightf. Fl. Scot.* p. 984; *With.* vol. iv. p. 133; *Dillw. Conf.* t. 54; *E. Bot.* t. 1479; *Esper, Fuc. Sup.* t. 4.

Conferva *imbricata.*—*Huds. Fl. Angl.* p. 603; *Roth, Cat.* vol. iii. p. 281.

Conferva *cancellata.*—*Roth, Cat.* vol. ii. p. 230.

Ceramium *equisetifolium.*—*De C. Syn.* p. 8.

Var. *simpliciflum.*—Stems more slender; ramuli straight, once divided.

*Harv. P. B.* plate 287.

Hab.—On rocks, at extreme low-water mark. Perennial. Summer. Common on the southern and western shores of England and Ireland; Wales; rare in Scotland; Frith of Forth (*Mr. Yalden, Lightf.*); Jersey (*Misses White, Turner*, and *Edgar, Mr. F. P. Girdlestone*).

Geogr. Dist.—Atlantic shores of Europe; Mediterranean Sea; Falkland Islands (*Agardh*).

Description.—Root, a very small disc, at length densely covered like the stem with woolly fibres. Fronds filiform, articulated throughout, three to six or nine inches long, and about half a line in diameter, cylindrical, much branched; branches irregular, very variable in length. Articulations cylindrical, about twice as long as broad, furnished at

the joints with dense whorls of three to four times dichotomous ramuli, articulated like the stem and branches, which are at length covered with a dense velvety pile of short ramuli. Substance rather rigid, and not very firmly adhering to paper in drying. Colour, "when fresh, a dark full red," changing to a dull brown when dry. Favellæ two- to three-lobed, terminal on short branches, scarcely involucrate. Tetraspores attached to the inner side of dichotomous, involucral ramuli, lateral on short stalks.

Besides the above, Dr. Harvey describes what he considers may be abnormal fructification or perhaps antheridia, consisting of "oval bodies composed of bundles of excessively fine dichotomous filaments, contained in involucres, similar to those occupied by tetraspores."—See *Phyc. Brit.* Plate lxvii.

It is curious that the present species should have been noticed for the first time as British on the Scotch shores, and that it has never been met with since in this country perhaps; the specimen collected then may have been only a stray one, picked up on the beach, and the plant after all not a native of Scotland. This seems the more likely, as we have not heard of its occurrence on the eastern shores of England. It seems, indeed, to prefer an ocean home, being mostly confined to the south and west of England and Ireland, and we are not aware of its occurrence even on the west of Scotland.

In structure and fructification the present exactly agrees with the other species of the genus, but the habit is so totally different that one almost feels regret that it cannot be placed in a different genus.

In habit, as Miss Gifford remarks, it somewhat resembles *Cladostephus verticillatus*, but in that the fructification and the colour, as well as the structure of the ramuli, are quite different.

The present species is by no means a favourite with collectors, except for its rarity, its stiff twig-like stems not being remarkable either for brilliancy of colouring or symmetry of form. In this, however, we choose to differ from most of our brethren, believing that variety is as essential an ingredient of beauty as form or colour, and the almost infinite variety in nature seems to keep us in countenance.

The constant recurrence of the same tint, however beautiful, of the same form, however symmetrical, would soon become tiresome, and of course disagreeable; an occasional mixture of plain colours and simple forms is always desirable even to set off to greater advantage the brilliancy of colour and delicacy of form in their more distinguished neighbours.

The form *simplicifilum* we have ventured to consider in the light of a variety, in accordance with the views of most algologists; the differences

being supposed merely such as would naturally result from a difference in the circumstances of growth and situation. It may be readily known from the normal state by the whorled ramuli being straight and only once divided, and by the much larger articulations.

EXPLANATION OF PLATE CXII.

Fig. 1.—*Griffithsia equisetifolia*, natural size.
2.—Branchlet with tetraspores.
3.—Branchlet with favellæ.
4.—Ramulus from involucre.
5.—Tetraspore.
6.—Variety *simplicifilum*. All magnified.

*Griffithsia equisetifolia, Ag.*

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## GRIFFITHSIA BARBATA.—*Ag.*

Gen. Char.—"Frond rose-red, filamentous; filaments jointed throughout, mostly dichotomous; ramuli single-tubed; dissepiments hyaline." Fructification of two kinds, on distinct plants: 1. Favellæ, surrounded by an involucre; 2. Tetraspores, attached to whorled "involucral ramuli." Name in honour of Mrs. Griffiths, well known for her numerous and valuable discoveries among British Algæ.

Griffithsia *barbata*.—Fronds slender, cylindrical, dichotomously branched; articulations clavate, much longer than broad, "terminal forks with very slender, dichotomous, whorled or opposite ramuli, bearing sessile tetraspores;" favellæ terminal on abbreviated ramuli.

Griffithsia *barbata*.—*Ag. Syst.* p. 145; *Ag. Sp. Alg.* vol. ii. p. 132; *Kütz. Sp.* p. 660; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 338; *Harv. P. B.* plate 281; *Harv. Man.* p. 168; *Harv. Syn.* p. 139; *Atlas*, plate 55, fig. 250; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 80.

Conferva *barbata*.—*E. Bot.* t. 1814.

Hab.—Parasitical on the smaller Algæ in tide-pools. Annual. Summer. Very rare, and seemingly confined to the coasts of the British Channel. Beach at Brighton (*Mr. Borrer*); Jersey (*Miss Turner*).

Geogr. Dist.—North coast of France; not uncommon in old oyster-beds, attached to the shells and small stones (*Lenormand*).

Description.—Fronds slender, tufted, two to three inches high, as thick as hogs' bristles at the base, regularly dichotomous; branches capillary, the upper ones furnished at the joints with opposite or whorled, byssoid, articulated ramuli, once or twice dichotomous. Articulations of the branches six to nine times longer than broad, clavate in their upper part, the tube filled with deep red endochrome. Substance very flaccid, closely adhering to the paper in drying. Colour, a fine bright rose-red, soon decomposing in fresh water, and becoming transparent. Favellæ in pairs, roundish obovate, terminal on short abbreviated branchlets, with an involucre of five to eight simple or once forked ramuli. Tetraspores attached to the inner edge of the apices of the first joint of the whorled ramuli, triparted, with a wide limbus.

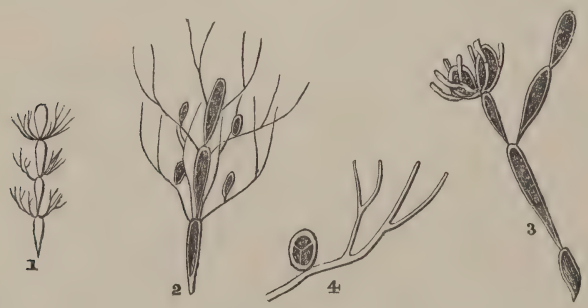
Like most of the species of the *Ceramiaceæ*, and indeed not a few of the more delicate species of Algæ, *Griffithsia barbata* is very intolerant of fresh water, owing to its difference of density from that of salt water. The greater pressure from within bursting the delicate cells, the coloured

endochrome flows out, staining the water of a bright crimson or rosy hue. This colour, however, is not permanent, as the granules themselves soon burst, the colouring matter becomes diffused through the water, and ultimately disappears. Some of the tints, however, are very beautiful, and were it possible to fix them, they might become valuable as dyes.

If not practicable for the use of the dyer, this is at least easily effected for the herbarium by using salt water instead of fresh in spreading out the specimens on paper, and removing all the superfluous moisture by means of blotting-paper, before putting them to press.

Miss Gifford has very kindly supplied us with beautiful specimens in fruit, of this fine and very rare species. From the preceding it may at once be known by the few and very delicate byssoid ramuli, confined to the upper branchlets of the frond, and to the inner edges of which the tetraspores are attached.

For the discovery of this pretty species we are indebted to Mr. Borrer, whose specimens were picked up on the beach at Brighton. We are not aware whether the species has ever been found growing on the British shores, all the specimens we have seen having been brought from Jersey, where it seems to be not unfrequent, its favourite haunts being the sheltered tide-pools near or below low-water mark, where it grows on the smaller Algæ.




GRIFFITHSIA BARBATA.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet with tetraspores.
2.—Same, more magnified.
3.—Favellæ.
4.—Tetraspore attached to fibre. All magnified.

## GRIFFITHSIA DEVONIENSIS.—*Harv.*

Gen. Char.—"Frond rose-red, filamentous; filaments jointed throughout, mostly dichotomous; ramuli single-tubed; dissepiments hyaline." Fructification of two kinds, on distinct plants: 1. Favellæ, surrounded by an involucre: 2. Tetraspores, attached to whorled "involucral ramuli." Name in honour of Mrs. Griffiths, well known for her numerous and valuable discoveries among British Algæ.

Griffithsia *Devoniensis.* — Frond gelatinous, very slender, filiform, dichotomous, lower branches patent; articulations cylindrical, six to eight times as long as their diameter; tetraspores attached to the inner edge of whorled, involucral ramuli.

Griffithsia *Devoniensis.*—*Harv. P. B.* plate 16; *Harv. Man.* p. 168; *Harv. Syn.* p. 139; *Atlas,* plate 55, fig. 251; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 79.

Hab.—Muddy sea-shores, in deep water. Rare. Plymouth (*Rev. W. S. Hore,* July, 1840); Salcombe (*Mrs. Wyatt,* Sept. 1840).—*Phyc. Brit.*

Geogr. Dist. —— ?

Description.—Fronds capillaceous, much tufted, and regularly dichotomous, two to four inches long; branches erecto-patent below, nearly erect above. Articulations of the main branches eight to ten times longer than broad, cylindrical, slightly thickened at each end, and rounded, much shorter upwards, the apices obtuse, quite destitute of whorled ramuli, except the involucres. Tetraspores obovate, triparted, produced on the inner edge, at the apices of the articulations of the involucres, which are composed of simple or forked, articulated, incurved ramuli whorled round the apices of the articulations of the main branches. Favellæ we have not seen. Substance gelatinous, very flaccid, and closely adhering to paper in drying. Colour, bright rose red, rapidly discharged in fresh water or when exposed to the light while moist.

This very pretty species has been selected by Dr. Harvey for the purpose of connecting, as he very aptly expresses it, the name of the late Mrs. Griffiths with her native county, so much indebted to her for numerous discoveries in almost every branch of Natural History.

For this purpose none certainly could have been more appropriate, not only from the beauty and delicacy of its structure, but as being

confined to that coast which she so long and so successfully explored, and the treasures of which she has so greatly helped to make known.

From the preceding it may be readily known by the absence of the whorled ramuli, by the articulations being swollen downwards as well as upwards, and when in fruit, by the densely whorled involucres, whose inner edge is often fringed from base to apex by the tetraspores, one being produced at the apex of each joint. The favellæ, so far as we are aware, are unknown, nor have we heard of any other localities than those given above, nor does the species seem as yet to be known anywhere abroad.

When carefully preserved, it is a very pretty species, and, like the other allied species of the genus, is beautifully glossy. Like them also, it should be spread out in salt water, and in order that the paper may retain as little of the salt water as possible, to prevent it getting damp afterwards, it may be dipped in fresh water first, and then the salt water will remain only on the surface, from which it can be mostly removed by the blotting-paper. For Plymouth specimens of this we are indebted to various obliging correspondents. Salcombe specimens we have not seen.

GRIFFITHSIA DEVONIENSIS.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet with tetraspores.
2.—Tetraspores in involucre.
3.—Ramulus from same, showing the position of tetraspores.
All magnified.

# Plate CXIII.

## GRIFFITHSIA CORALLINA.—*Ag.*

Gen. Char.—"Frond rose-red, filamentous; filaments jointed throughout, mostly dichotomous; ramuli single-tubed; dissepiments hyaline." Fructification of two kinds, on distinct plants: 1. Favellæ, surrounded by an involucre; 2. Tetraspores, attached to whorled "involucral ramuli." Name in honour of Mrs. Griffiths, well known for her numerous and valuable discoveries among British Algæ.

Griffithsia *corallina.* — Fronds gelatinous, cylindrical, filiform; branches dichotomous, patent; lower articulations clavate, upper elliptical; involucres of the tetraspores whorled, those of the favellæ lateral, short, spine-like, incurved.

Griffithsia *corallina.*—*Ag. Syn.* p. 28; *Hook. Fl. Scot.* part 2, p. 84; *Ag. Syst.* p. 145; *Ag. Sp. Alg.* vol. ii. p. 127; *Wyatt, Alg. Danm.* No. 89; *Kütz. Phyc. Gen.* p. 374; *Endl.* 3rd Suppl. p. 35; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 338; *Harv.* in *Mack. Fl. Hib.* part 3, p. 212; *Harv. P. B.* plate 214; *Harv. Man.* p. 168; *Harv. Syn.* p. 140; *Atlas*, plate 55, fig. 252; *Harv. N. B. A.* part 2, p. 228; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 78.

Callithamnion *corallinum.*—*Lyngb. Hyd. Dan.* p. 126.

Conferva *corallina.*—*Linn. Sp. Pl.* p. 1636; *Lightf. Fl. Scot.* p. 988; *With.* vol. iv. p. 136; *Mohr, Isl.* p. 250; *Roth, Cat. Bot.* vol. iii. p. 225; *Dillw. Conf.* t. 98; *E. Bot.* t. 1825.

Conferva *corallinoides.*—*Linn. Sp. Pl.* 1st edit. p. 1166; *Huds. Fl. Angl.* p. 598.

Conferva *geniculata.*—*Ellis*, in *Phil. Trans.* vol. lvii. p. 425, t. 18, fig. F, f.

Conferva *marina gelatinosa, corallinæ instar geniculata crassior.*—*Dillw. Musc.* vol. xxxiii. t. 6, f. 36.

Hab.—On rocks, stones, and shells in pools near low-water mark. Annual. Summer and early autumn. Not uncommon all round our coasts.

Geogr. Dist.—Atlantic and Mediterranean shores of Europe; Faroe Islands; Iceland; North America; Tasmania.

Description.—Root, a minute "disc." Fronds tufted, one to five inches or more in length, one-fourth of a line in breadth, much branched dichotomously; branches cylindrical, erecto-patent, short and subfastigiate; lower articulations clavate, with rounded apices, four to five times longer than broad; upper short, elliptical, apical, roundish, all filled with dark red endochrome. Favellæ two or three together, sessile on the lateral apices of the joints of the principal branches, involucre con-

sisting of five to six short, incurved, tooth-like ramuli, scarcely longer than the favellæ. Substance gelatinous, very flaccid, and closely adhering to paper. Tetraspores clustered in dense sessile whorls, round the apices of the middle articulations, the whole surrounded by an involucre of six to eight spines, similar to those of the favellæ : they are obpyriform or obovate, scarcely stalked and tripartite. Colour, a deep transparent crimson red, rapidly discharged in fresh water, by the bursting of the tubes.

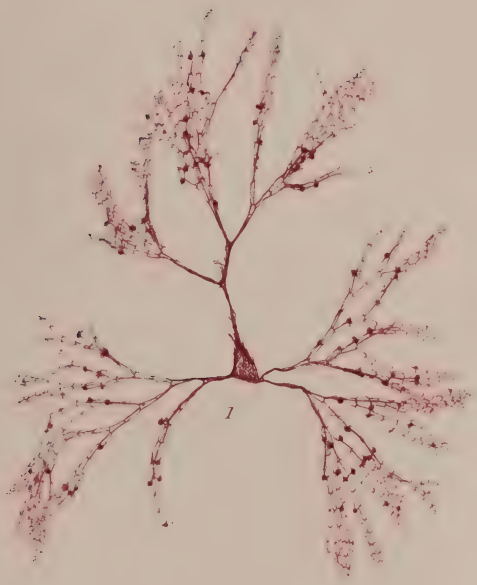
This handsome species is said to be of not unfrequent occurrence on all the British shores, and seems to have all but a cosmopolitan distribution.

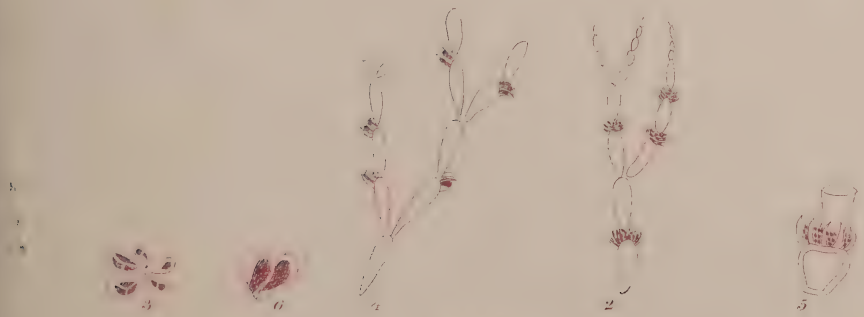
It is one of the earliest observed species, and figures conspicuously in all the older works on sea-weeds, from its bright colours and large and distinctly marked articulations. It is said not to be unfrequent on the shores of Ireland, and is represented, as Dr. Harvey informs us (*Phyc. Brit.*), by a gigantic form, which he considers a variety of the present, in Tasmania.

It should be looked for in deep, clear rock-pools near low-water mark, where its bright colours and rather stout articulate fronds will readily betray its presence. It is readily distinguished from the last species by its larger size, thicker stems, and the clavate articulations, but still better by the single-jointed tooth-like ramuli of the involucres, and the lateral favellæ. The resemblance of the articulations to those of *Corallina* has not inaptly suggested the specific name, but with stony species its soft and delicate fronds are not likely otherwise to be confounded.

EXPLANATION OF PLATE CXIII.

Fig. 1.—*Griffithsia corallina*, natural size.
2.—Branchlet with tetraspores.
3.—Tetraspores.
4.—Branchlet with favellæ.
5.—Joint with same.
6.—Favellæ. All magnified.




*Griffithsia coralliina*, Ag.

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# Plate CXIV.

## GRIFFITHSIA SECUNDIFLORA.—*J. Ag.*

Gen. Char.—"Frond rose-red, filamentous; filaments jointed throughout, mostly dichotomous; ramuli single-tubed; dissepiments hyaline." Fructification of two kinds, on distinct plants: 1. Favellæ, surrounded by an involucre; 2. Tetraspores, attached to whorled "involucral ramuli." Name in honour of Mrs. Griffiths, well known for her numerous and valuable discoveries among British Algæ.

Griffithsia *secundiflora*. — Fronds cylindrical, much branched; branches irregular, mostly dichotomous, somewhat flabellate upwards, ultimate ramuli cylindrical, very obtuse, frequently secund; articulations cylindrical, two to three or nearly four times as long as broad, scarcely shorter upwards.

Griffithsia *secundiflora*.—*J. Ag.* in *Linn.* vol. xv. p. 39; *Alg. Medit.* p. 75; *Mont. Algier.* p. 141; *Endl.* 3rd Suppl. p. 35; *Harv. P. B.* plate 135; *Harv. Man.* p. 169; *Harv. Syn.* p. 140; *Atlas*, plate 54, fig. 246; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 86.

Griffithsia *crassa*.—*Kütz. Phyc. Gen.* p. 374.

Griffithsia *intermedia*.—*Lenorm.* in *Herb.*

Griffithsia *corallina*, β.—*Bonn. Hyd.* loc. p. 96.

Ceramium *corallinum*, var. *magus*.—*Desmaz. Crypt. Fr.* No. 1032.

Ceramium *Desmazieri*.—*Crouan MS.*

Hab.—On rocks and other Algæ, at extreme low-water mark. Annual? Bovisand, near Plymouth (*Rev. W. S. Hore*).

Geogr. Dist.—Atlantic coasts of France and Spain; Mediterranean Sea.

Description.—Root, a mass of creeping fibres. Fronds filiform, cylindrical, much branched and tufted, four to eight inches in length, and about one-sixth of a line in diameter; branches more or less dichotomous, frequently secund, all very erect and subflabellate upwards, all of equal thickness throughout, even to the apices, which are rounded and obtuse; towards the base short root-like ramuli are not unfrequent. Articulations cylindrical, two to three or three and a-half times longer than broad, with very thick hyaline tubes; the dissepiments wide and hyaline, the ends of the articulations not rounded. Substance rather firm, slightly gelatinous, and firmly adhering to the paper in drying. Colour, a fine deep transparent crimson red, rapidly discharged in fresh

water. Fruit of either kind we have not seen, and are not aware of its having been found in Britain.

This fine species may be known from the preceding by its rather shorter, cylindrical joints, and more erect, branching, and obtuse points, and from the following by its larger size, more gelatinous substance, and by the cylindrical branches not in the least tapering at the points.

It was discovered near Plymouth in 1846, by the Rev. W. S. Hore, and has been since repeatedly found in the same place by other botanists, but we have not seen specimens from any other British station. On the shores of Continental Europe it is much less rare, but becomes more so as we proceed northwards, on the British shores has ceased to fructify, and has reached its northern limit in the above station. Even on French specimens the fruit seems to be rather uncommon, as we have not seen it on any collection of specimens from that country. The favellæ "resemble those of *G. setacea*, but placed on shorter stalks."

This species is said to be perennial, and if so, it differs from most of its allies if not from all; we see nothing in the appearance of the plant to lead us to suppose it a perennial.

It is also generally supposed to grow on rocks, but our specimens are mostly attached to *Corallina officinalis*. Most of the species of this genus, however, are rather rare in this country, and many of the facts connected with their growth and distribution require confirmation.

EXPLANATION OF PLATE CXIV.

Fig. 1.—*Griffithsia secundiflora*, natural size.
2.—Apex of the frond.
3.—Base of same. Both magnified.

*Griffithsia secundiflora, J. Ag.*

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# Plate CXV.

## GRIFFITHSIA SETACEA.—*Ag.*

Gen. Char.—"Frond rose-red, filamentous; filaments jointed throughout, mostly dichotomous; ramuli single-tubed; dissepiments hyaline." Fructification of two kinds, on distinct plants: 1. Favellæ, surrounded by an involucre; 2. Tetraspores, attached to whorled "involucral ramuli." Name in honour of Mrs. Griffiths, well known for her numerous and valuable discoveries among British Algæ.

Griffithsia *setacea*. — Fronds filamentous, setaceous, rather rigid and straight, dichotomously branched; branches erect; articulations cylindrical, those of the main stems five to six times longer than broad; fructification lateral, on jointed stalks.

Griffithsia *setacea*.—*Ag. Syn.* p. 28; *Ag. Syst.* p. 144; *Ag. Sp. Alg.* vol. ii. p. 129; *Grev. Fl. Edin.* p. 312; *Hook. Br. Fl.* vol. ii. p. 338; *Wyatt, Alg. Danm.* No. 137; *Endl.* 3rd Suppl. p. 35; *Kütz. Phyc. Gen.* p. 373; *Hook. fil. Fl. Ant.* vol. i. p. 191; *Harv.* in *Mack. Fl. Hib.* part 3, p. 212; *Harv. P. B.* plate 184; *Harv. Man.* p. 169; *Harv. Syn.* p. 141; *Atlas*, plate 55, fig. 253; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 84.

Conferva *setacea*.—*Ellis, Phil. Trans.* vol. lvii. t. 18 f, e; *Turn. Linn. Trans.* vol. vii. p. 107; *Huds. Fl. Angl.* p. 599; *With. Pl.* vol. iv. p. 137; *E. Bot.* t. 1689; *Dillw. Conf.* t. 82; *Roth, Cat. Bot.* vol. iii. p. 278.

Hab.—In shady rock-pools, generally near low-water mark. Annual? Spring, summer, and early autumn. Common.

Geogr. Dist.—Atlantic shores of Europe and America; Southern Ocean.

Description.—Root, a mass of creeping fibres. Fronds much tufted, filamentous, setaceous, two to six or eight inches long, as thick as fine hair, much branched in a more or less regularly dichotomous manner; branches sometimes opposite, very erect, with acute axils, cylindrical below, setaceous upwards, the apices acute, frequently much matted near the base, and entangled by small lateral root-like processes. Articulations cylindrical, those of the main stems five to six times as long as broad, shorter upwards, all cylindrical, apical one conical acute. Substance rather firm and rigid when fresh, but soon becomes flaccid on exposure to the air or in fresh water, and adheres, but not very strongly, to paper. Colour, a fine transparent crimson, rapidly discharged in fresh water "with a crackling noise," from the rupture of the membranous walls of the tubes. Favellæ produced on the inner faces of short, incurved involucral ramuli, oval, mostly in pairs. Tetraspores

triparted, similarly situated as the favellæ; both kinds of involucres are placed on short, two-jointed, slender stalks, and occupy the place of a metamorphosed ramulus.

One of our most beautiful species, and the only one, so far as we are aware, with the exception of *G. corallina*, which is certainly a native of our Scottish shores. It is one of the earliest known to collectors, and is still one of the greatest favourites. It is not one of our common plants on the east coast, but we have met with it sparingly in several localities, growing in deep very shady pools, along with *Callithamnion Turneri*. With us, however, it is certainly an annual or at least deciduous.

We have never seen fruit on Scotch specimens, and even on those from the south of England, which are much more luxuriant, it seems to be produced but sparingly.

The pools in which it grows with us are by no means situated near low water, but they are never entirely empty, so that the plant is always more or less under water; it invariably selects the south side of the pool, where it is in every instance shaded by over-hanging rocks from the sun during the most of the day, and indeed the sun can only reach it at all during the longest days.

Impatient as it is of light and air, Dr. Harvey mentions a curious circumstance of its having lived upwards of two years in a closed bottle in sea-water (*Phyc. Brit.*) without showing any symptoms of decay. No sooner, however, is the plant placed in fresh water than its delicate membranous cells burst, and the colouring matter flows out, staining the water or the paper on which it is placed of a fine rosy tint, which, as Dr. Harvey observes, remains for a long time.

We have seen specimens put in paper, without the fresh water having been removed by blotting, and next day when the plants were changed to fresh paper, every atom almost of the colouring matter had been transferred from the specimens to the paper, leaving the stems perfectly transparent.

It seems worthy of remark, that although the greater part of the specimens in some of our localities were removed in 1858, the plants are much more abundant this season than last, although no fruit was observed on any of the specimens.

EXPLANATION OF PLATE CXV.

Fig. 1.—*Griffithsia setacea*, natural size.
2.—Branchlet with favellæ.
3.—Favellæ.
4.—Branchlet with tetraspores.
5.—Ramulus from involucre with tetraspores.
6.—Tetraspores from same. All magnified.

GRIFFITHSIA setacea. Ag.

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# Plate CXVI.

## CORYNOSPORA PEDICELLATA.—*J. G. Ag.*

Gen. Char.—Fronds filiform, cylindrical, dichotomous, joints pellucid, single-tubed. Fructification of two kinds, on distinct plants: 1. Favellæ, unknown to us; 2. Tetraspores, on short pedicels, opposite the ultimate dichotomies. Name, from *κορύνη*, "a club;" and *σπορὰ*, "a seed."

Corynospora *pedicellata*.—Stems filiform, cylindrical, much branched; branches dichotomous, setaceous, beset from near the base with short once or twice dichotomous ramuli.

Corynospora *pedicellata*.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 71.

Callithamnion *pedicellatum*.—*Ag. Sp. Alg.* vol. ii. p. 174; *Wyatt, Alg. Danm.* No. 94; *J. Ag. Alg. Medit.* p. 73; *Kütz. Phyc. Gen.* p. 371; *Endl.* 3rd Suppl. p. 34; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 347; *Harv.* in *Mack. Fl. Hib.* part 3, p. 217; *Harv. P. B.* plate 212; *Harv. Man.* p. 182; *Harv. Syn.* p. 155; *Atlas*, plate 60, fig. 283.

Callithamnion *clavatum*.—*Ag. Sp. Alg.* vol. ii. p. 180; *J. Ag. Alg. Medit.* p. 73; *Kütz. Phyc. Gen.* p. 371; *Mont. An. Sc. Nat.* 1839, p. 166; *Endl.* 3rd Suppl. p. 34.

Callithamnion *Perreymondii*.—*Duby, Mem.* vol. ii. t. 4, f. 5.

Callithamnion *botryticum*.—*De Not.* (fide *Lenorm.*).

Griffithsia *irregularis*.—*Kütz. Actien.* 1836.

Ceramium *pedicellatum*.—*Ag. Syst.* p. 137.

Ceramium *clavægerum*.—*Bonn. Hyd.* loc. in *An. Mus. Par.* 1825, p. 90.

Conferva *pedicellata*.—*E. Bot.* t. 1817; *Dillw. Conf.* t. 108.

Hab.—On rocks, stones, old shells, and pieces of wood in deep rock-pools. Dredged in from three to eight fathoms water. Not uncommon all round the coast.

Geogr. Dist.—Atlantic shores of France; Mediterranean Sea.

Description.—Root, a minute disc, accompanied with fibres. Fronds filiform, cylindrical, much tufted, long, slender, much branched from near the base, two to four inches long, as thick as bristles; branches setaceous, slender, erecto-patent or suberect, everywhere beset with short, once or twice dichotomous, suberect ramuli, which are suberect, straight or somewhat incurved, cylindrical, the apices obtuse, the axils acute, every joint emitting its ramulus in a somewhat alternate manner. Favellæ unknown to us. Tetraspores (?) obpyriform, on short stalks, situated at the axils of the ramuli, and containing a single spore. Substance, "when freshly

gathered somewhat crisp, soon becoming flaccid," closely adhering to paper. Colour, "a clear pinky red" when newly gathered, but rapidly changing in fresh water and in drying to a dull yellowish brown, and communicating the same colour to the paper.

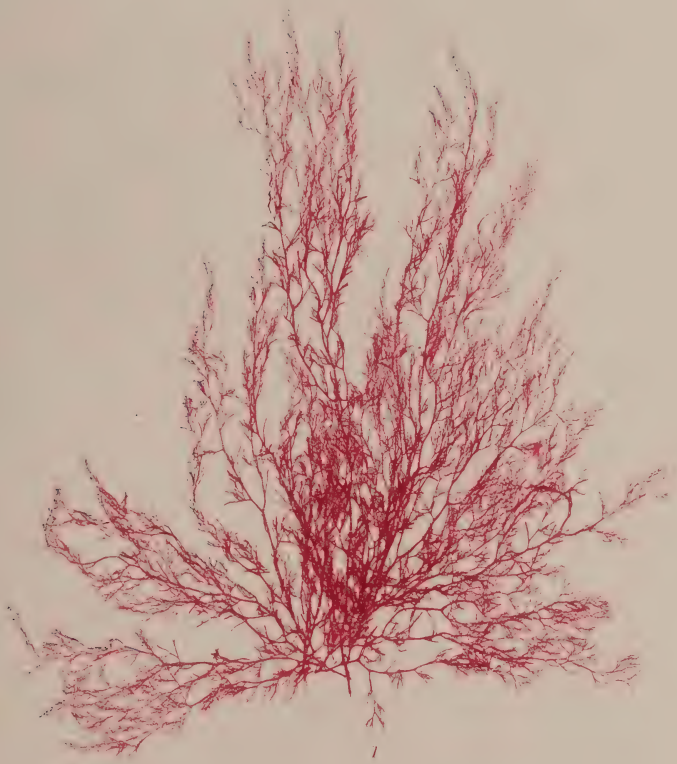
At one time considered one of the rarest of our British Algæ, the present species has been found of late years in many different localities, especially on our southern shores, and extends its range to the west of Scotland, and even to Orkney (*Phyc. Brit.*). but in the latter countries it seems to be rare, and has not been found, so far as we are aware, on the east coast.

In the structure of its fronds it scarcely differs from some of the pellucid-jointed species of *Callithamnion*, with which it has till lately, and perhaps without any great inconvenience or impropriety, been arranged.

When the true nature of the fructification is better known, the affinities of the species may be more satisfactorily determined, and we think it not impossible but that, should the genus *Callithamnion* remain entire, as at present, it may again become associated with its former congeners. Should the fruit prove to be identical with that of *Callithamnion*, the minor differences of habit would scarcely be sufficient to keep them apart.

EXPLANATION OF PLATE CXVI.

Fig. 1.—*Corynospora pedicellata*, natural size.
2.—Branchlet with tetraspores, magnified.
3.—The same, more highly magnified.



*Corynospora pedicellata, J. G. Ag.*

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# Plate CXVII.

## SEIROSPORA GRIFFITHSIANA.—*Harv.*

Gen. Char.—Frond rosy, filamentous ; stem articulated, one-tubed ; the articulations traversed by jointed filaments ; branches jointed, one-tubed. Fruit, oval tetraspores disposed in terminal moniliform strings.—(*Phy. Brit.* pl. 21). Name from σειρὰ, "a chain ;" and σπορὰ, "a seed," from the chain-like tetraspores.

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Seirospora *Griffithsiana.—Harv. P. B.* plate 21 ; *Harv. Man.* p. 170 ; *Harv. Syn.* p. 142 ; *Atlas*, plate 54, fig. 249.

Callithamnion *seirospermum.—Griff.* in *Harv. Man.* 1st ed. p. 113.

Callithamnion *versicolor*, β *seirospermum.—Harv.* in *Hook. Journ. Bot.* vol. i. p. 302 ; *Harv.* in *Mack. Fl. Hib.* part 3, p. 216 ; *Wyatt, Alg. Danm.* No. 19.

Ceramium *seirospermum.—J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 42.

Hab.—On rocks, stones, and old shells in the sea, in three to eight fathoms water. Rare ? Annual. Summer. Torquay (*Mrs. Griffiths*) ; Salcombe (*Mrs. Wyatt*) ; Portaferry (*Mr. W. Thompson*) ; Arran (*Rev. D. Landsborough*) ; Peterhead (*Miss C. Allardice*) ; Orkney (*Rev. J. H. Pollexfen*).

Geogr. Dist.—British Islands ; Sweden (*Areschoug*).

Description.—Root, a minute disc. Fronds "solitary or slightly tufted," one to two or three inches in length, more or less opaque and veiny, very slender and filamentous, setaceous upwards ; branches long, slender and patent, numerous, the lower longest, shorter upwards, giving the frond a pyramidal outline, more or less waved, and set with subdichotomous multifid ramuli. Articulations of the stem three to four times as long as broad, of the ramuli two to four times, nearly cylindrical or slightly swollen at the summit. Structure composed of a single articulated tube, more or less filled with jointed filaments, arising from the bases of the branches, and proceeding downwards towards the root. Substance gelatinous, and closely adhering to the paper in drying. Colour, a fine transparent crimson red. Favellæ unknown. Tetraspores elliptical, tripartite, formed in strings by the metamorphosis of the cells of the ultimate ramuli.

This very beautiful and curious species was first added to the British flora in 1833, by Mrs. Griffiths, and described as a variety of *Callithamnion versicolor* by Dr. Harvey, under the impression that the fruit might

be merely an abnormal condition of the fruit of that genus; so anomalous indeed is the fructification, that Professor Harvey was slow to consider it other than abnormal, but as no other was observed, and that appeared to be constant to the species, a new genus was consequently formed for its reception.

In structure and habit it is closely allied to several other species of *Callithamnion*, the jointed fibres that occupy the interior being common to more than one species of the genus, so that the difference in the fructification is almost the only one characteristic of the new genus.

It is to be hoped that this interesting plant may be found more generally distributed than it has hitherto been supposed, and that its close resemblance to several species of the genus *Callithamnion* may have caused it to be overlooked.

It would prove a great benefit to science if collectors would all become observers; we have often to regret that specimens from correspondents have nothing but the name attached, and that we at times require to change. It is indeed the only particular which we could easily supply, whereas many interesting facts connected with the occurrence, duration, or appearance of the species, which would be of the greatest value, can only be recorded by the collector, and can rarely be obtained, by any amount of study, from herbarium specimens.

## EXPLANATION OF PLATE CXVII.

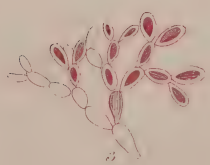
Fig. 1.—*Seirospora Griffithsiana*, natural size.
2.—Portion of a branch.
3.—Branchlet with tetraspores.
4.—Tetraspores from same. All magnified.

1

2

4

3



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*Stilosporа Griffithsiana, Harv.*

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# Plate CXVIII.

## CALLITHAMNION PLUMULA.—*Lyngb.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *plumula.*— Fronds distichous, subdichotomous, each articulation bearing at its summit a pair of short recurved pinnæ, bipectinated on their upper edge.

Callithamnion *plumula.*—*Lyngb. Hyd. Dan.* p. 127; *Ag. Sp. Alg.* vol. ii. p. 159; *Wyatt, Alg. Danm.* No. 138; *Endl.* 3rd Suppl. p. 34; *Hook. fil. Fl. Antarct.* vol. ii. p. 489; *J. Ag. Alg. Medit.* p. 71; *Kütz. Phyc. Gen.* p. 372; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 339; *Harv.* in *Mack. Fl. Hib.* part 3, p. 213; *Harv. P. B.* plate 242; *Harv. Man.* p. 171; *Harv. Syn.* p. 142; *Atlas*, plate 55, fig. 254; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 29.

Ceramium *plumula.*—*Ag. Syn.* p. 62; *Ag. Syst.* p. 142.

Conferva *plumula.*—*Ellis, Phil. Trans.* vol. lvii. t. 18; *Dillw.* t. 50.

Conferva *Turneri.*—*Sm. E. Bot.* t. 1637, not 2339.

Hab.—On rocks, stones, shells, and Algæ, near low-water mark, and in three to eighteen fathoms water. Annual. Summer. Common all round our coasts.

Geogr. Dist.—Atlantic shores of Europe, and North America; Mediterranean Sea; Cape Horn (*Dr. Hooker*); Tasmania (*Gunn*).

Description.—Root, a minute disc. Fronds densely tufted, two to four or six inches in length, capillaceous, branched; branches distichous, mostly dichotomous, sometimes alternate or secund. Stem and branches pellucid throughout, and every articulation bearing near its summit a pair of opposite, short, patent and generally recurved pinnæ, twice or even in luxuriant specimens three times pectinated on their upper edge; the pinnules erecto-patent, those at the base longest, gradually becoming shorter upwards, and slightly curved. In very luxuriant specimens, the joints are frequently furnished with an additional pair of pinnæ at right angles to the others. Substance very flaccid, and adhering very closely to the paper in drying. Colour, a fine rich carmine when fresh, becoming dull brownish yellow in decay. Favellæ clustered, terminal on short,

abbreviated branches. Tetraspores terminal on the apices of the ultimate ramuli.

This beautiful species, one of the prettiest of a very handsome genus, is by no means of unfrequent occurrence in this country, and Dr. Harvey informs us (*Phyc. Brit.*) that it is frequent in the Mediterranean, and that he has received specimens from Tasmania, Cape Horn, and North America, showing that in the temperate latitudes of both the northern and southern hemispheres it is widely distributed. To the naked eye the species presents nothing very distinct or remarkable, but seen through the microscope the peculiar ramification is very apparent, is most beautiful, and can never be mistaken for any other. The naked eye, however, fails to detect anything in the external habit of the plant which will readily form a *primâ facie* character, and we have no doubt that this delicate little gem is in consequence often overlooked, and may yet be found in many places where its presence has not yet been detected.

Although no plant is more constant to its characters, yet these often present considerable latitude in their development, according to the luxuriance of the specimen. In small specimens the plumules are often only once pectinated, whilst in those of more luxuriant growth they are occasionally thrice, or even some of the lower ones partially and rarely four times pectinated, and Dr. Harvey mentions a variety in which they were twice the usual length but much more slender.

We scarcely know a more beautiful object for the microscope than a fragment of the present species, especially when in fruit; the beautiful regularity of the closely pectinated ramuli, the deep tint of the internal bag of endochrome, enclosed in its pellucid cylinder, dotted over with deep red fruit, render it exceedingly beautiful.

EXPLANATION OF PLATE CXVIII.

Fig. 1.—*Callithamnion plumula*, natural size.
2.—Plumule with favellæ.
3.—Same, more magnified.
4.—Pinnule with tetraspores.
5.—Tetraspores from same. All magnified.

*Callithamnion plumula*, Lyngb.

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## CALLITHAMNION CRUCIATUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *cruciatum.*—Fronds irregularly branched, between alternate and dichotomous, each articulation furnished at its summit with two to four slender pinnate branches; tetraspores elliptical, formed by the metamorphosis of the lower pinnæ.

Callithamnion *cruciatum.*—*Ag. Syst. Alg.* vol. ii. p. 160; *Wyatt, Alg. Danm.* No. 182; *J. Ag. Alg. Medit.* p. 70; *Endl.* 3rd. Suppl. p. 34; *Hook. fil. et Harv.* in *Lond. Journ. Bot.* vol. vi. p. 412; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 339; *Harv. P. B.* plate 164; *Harv. Man.* p. 171; *Harv. Syn.* p. 143; *Atlas,* plate 55, fig. 255; *Harv. N. B. A.* part 2, p. 240; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 27.

Var. β *pumilum.*—Smaller, joints shorter, and the ramuli more dense.

β *pumilum.*—*Harv. P. B.* descrip. plate 164; *Harv. Man.* p. 172; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 28.

Callithamnion *pumilum.*—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 339; *Endl.* 3rd Suppl. p. 34; *Harv.* in *Mack. Fl. Hib.* part 3, p. 213.

Hab.—On mud-covered rocks, near low-water mark. Annual. Summer. Rather rare. Torquay (*Mrs. Griffiths*); Salcombe (*Mrs. Wyatt*); Milford Haven (*Mr. Ralfs*); Plymouth (*Rev. W. S. Hore*); Cork Harbour (*Dr. J. R. Harvey*); Coast of Down (*Mr. W. Thompson*); Ferriters Cove, Kerry (*Mr. W. Andrews*); β, Miltown Malbay (*Dr. Harvey*).

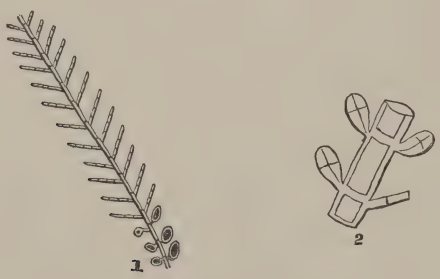
Geogr. Dist.—Atlantic shores of France and Spain; Mediterranean and Adriatic Seas; Tasmania (*Mr. Gunn*).

Description.—Fronds much tufted, one to two inches long, slightly branched, the divisions mostly alternate, sometimes dichotomous, all joints furnished with two to four long, slender, cylindrical, erecto-patent, pinnated ramuli, the pinnæ about thirteen, erect or erecto-patent, long, cylindrical, and opposite, the two or three apical joints only tapering to an obtuse point; apices of the branchlets ocellated from the density of the nascent ramuli, somewhat in the manner of *Dasya ocellata* and *arbuscula.* Articulations of the stem three to three and a-half times longer than broad, those of the ramuli slightly shorter, those of the pinnæ about once and a-half as long as broad, with the dissepiments

slightly contracted. Favellæ unknown to us. Tetraspores elliptical, cruciate, formed from the metamorphosis of the lower pinnæ, sessile or very shortly stalked. Substance somewhat flaccid, and not very perfectly adhering to the paper in drying. Colour, a rather dull red.

This very pretty species is best known from its congeners by its sparingly branched fronds, the long, slender, opposite or cruciate ramuli, and their equally slender and numerous pinnæ, all of nearly the same length, giving the branches and the ramuli a linear outline. The densely bushy apices of the ramuli will further serve to distinguish it, as they add greatly to the beauty of the plant. The length of the joints is rather variable, but those of the pinnæ are much shorter in proportion than those of the other parts of the plant.

Its favourite habitat seems to be the low sand or rather mud-covered rocks between tides, where from its small size, and being often partially covered with mud, it may escape detection, but the beauty of its delicate and minute fronds will well repay the trouble of a little searching in its rather obscure haunts.




CALLITHAMNION CRUCIATUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Ramulus with tetraspores.
2.—Tetraspores from same. Both magnified.

## CALLITHAMNION FLOCCOSUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular, and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *floccosum.*—Frond much branched; branches scattered at very irregular distances, each articulation furnished throughout near its summit with a pair of opposite, simple, minute, subulate ramuli, near the base of which are seated the triparted tetraspores.

Callithamnion *floccosum.*—*Ag. Sp. Alg.* vol. ii. p. 158 (excl. syn. *Dillw.*); *Endl.* 3rd. Suppl. p. 34; *Harv. P. B.* plate 81; *Harv. Man.* p. 172; *Harv. Syn.* p. 144; *Atlas*, plate 57, fig. 263; *Harv. N. B. A.* part 2, p. 240; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 27.

Callithamnion *plumula.*—*Lyngb. Hyd. Dan.* p. 127 (excl. var. β).

Callithamnion *Pollexfenii.*—*Harv.* in *Ann. Nat. Hist.* vol. xiv. p. 186, t. 5, f. 5—7.

Conferva *floccosa.*—*Fl. Dan.* t. 828.

Hab.—On submarine mud-covered rocks, near low-water mark, and in intratidal pools on stones. Annual. Spring. Rare. Orkney (*Rev. J. H. Pollexfen*); Aberdeen (*Dr. Dickie*); Forfarshire coast (*Mr. A. Croall*); Peterhead (*Mr. T. Bell*).

Geogr. Dist.—North of Scotland; Coast of Norway.

Description.—Fronds one to three inches long, much tufted and branched; branches often very distant below, more closely placed upwards, mostly alternate, erecto-patent, the lower part of the branch often naked more than half-way, the divisions collected near the summit, and frequently curved upwards. Articulations of the main branches two to three or occasionally four times longer than broad, each furnished near its summit with a pair of opposite, minute, spine-like ramuli, of about six to eight articulations, arising from a little above the middle of the articulation, which is rather longer than broad. Substance rather flaccid, but not adhering very tenaciously to the paper. Colour, a pale rather dull transparent red. Favellæ appear not to have been seen in this country. Tetraspores are by no means common; they arise from the lower articulations of the ramuli, and are very minute, triparted, on very short stalks.

First observed in the Orkney Islands by the Rev. J. H. Pollexfen, and published as new in the *Annals of Natural History* for 1844, under the name of *C. Pollexfenii*, by Dr. Harvey, who afterwards found it to be identical with the *C. floccosum* of Agardh and of *Flora Danica*.

It is perhaps better distinguished by its straggling habit and simple ramuli than by any other character. The ramuli are extremely short and spine-like, rarely with more than six or seven articulations, and are almost invariably simple, pretty regularly opposite, but frequently wanting, especially in the lower parts of the stem and branches, seldom in the upper.

It seems rather a northern species; we have not heard of its occurrence in England, and on the Scottish shores it is by no means frequent, occurring in single plants, and at wide intervals. We have met with it several times on the Forfarshire coast, but it is not common, and very rarely in fruit. Its favourite habitat seems to be the large stones in intratidal pools which are always under water, on which it sometimes forms considerable tufts.

The articulations are generally somewhat inflated, but when branched, contracted at their insertion. We are just favoured with a communication from our good friend Mr. T. Bell of Peterhead, regarding this species, in which he says: "It is common at Peterhead. I have found it with favellæ at the tips of the branches, surrounded by a tuft of fine branchlets. It is very common this year, and was last, with favellæ—the year before much rarer." Along with this communication we have received several fine specimens confirmatory of the above remarks, so that the sentence in our "description"—"Favellæ appear not to have been seen in this country"—must be cancelled.

CALLITHAMNION FLOCCOSUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet.
2.—Portion of same with tetraspores.
3.—A tetraspore. All magnified.

## CALLITHAMNION TURNERI.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *Turneri*.—Fronds arising from creeping fibres, simple or two to three times pinnated, pinnæ rather patent, cylindrical, very slender; articulations of the main stems five to eight or ten times longer than broad; favellæ stalked, furnished with an involucre; tetraspores clustered.

Callithamnion *Turneri*.—*Ag. Syst. Alg.* vol. ii. p. 100; *Wyatt, Alg. Danm.* No. 183; *J. Ag. Alg. Medit.* p. 70; *Endl.* 3rd Suppl. p. 34; *Kütz. Phyc. Gen.* p. 373; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 339; *Harv.* in *Mack. Fl. Hib.* part 3, p. 217; *Harv. P. B.* plate 179; *Harv. Man.* p. 172; *Harv. Syn.* p. 144; *Atlas*, plate 58, fig. 266; *Harv. N. B. A.* part 2, p. 241; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 23.

Callithamnion *repens*.—*Lyngb. Hyd. Dan.* p. 128, t. 40; *Ag. Sp. Alg.* vol. ii. p. 184; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 348; *Harv.* in *Mack. Fl. Hib.* part 3, p. 218; *Harv. Man.* 1st ed. p. 115; *Kütz. Phyc. Gen.* p. 372.

Callithamnion *variabile*.—*Ag. Sp. Alg.* vol. ii. p. 163; *Kütz. Phyc. Gen.* p. 372.

Ceramium *Turneri*.—*Roth, Cat.* vol. iii. p. 128, t. 5; *Ag. Syst.* p. 142; *Grev. Crypt.* t. 355.

Ceramium *repens*.—*Ag. Syn.* p. 63; *Ag. Syst.* p. 131.

Conferva *Turneri*.—*Dillw.* t. 100; *E. Bot.* t. 2339 (not t. 1637).

Conferva *repens*.—*Dillw.* t. 18; *Roth, Cat.* vol. iii. p. 221; *E. Bot.* t. 1608; *Fl. Dan.* t. 1665.

Conferva *tenella*.—*Dillw. Syn.* p. 72, t. F.

Var. β. Branches alternate, distant, and sparingly divided.

Hab.—Parasitical on other Algæ, between tide-marks. Annual. Summer. Common.

Geogr. Dist.—Atlantic shores of Europe and North America; Mediterranean Sea.

Description.—Root composed of creeping fibres, which attach themselves to other plants by small discs. Fronds densely tufted, slender, cylindrical, from one to two or three inches long, capillaceous, simple or two to three times pinnated; pinnæ in the normal form opposite, erecto-patent or nearly patent, all very slender and cylindrical, scarcely

tapering, except at the apex. Articulations cylindrical, very variable, generally from five to seven times longer than broad, but often much longer, those of each division becoming shorter; dissepiments wide and very distinct, apical articulation conical, obtuse. Substance rather flaccid, and more or less adhering to paper. Colour, a rather dull brownish red, not changing much in drying. Favellæ somewhat roundish, bilobed, lateral on short stalks, with an involucre of from three to four spine-like ramuli, about as long as the favellæ. Tetraspores spherical, sessile on the upper edge of short ramuli, which are either simple or clustered at the apices of short stalks.

This species is almost intermediate between the present genus and that of *Griffithsia*, and in a natural arrangement ought perhaps to be placed next that genus, as its tetraspores sometimes present an arrangement somewhat resembling those of *Griffithsia*, but the arrangement is not perfect or constant, and it appears to us that the species still requires to be better known before it can be said to be well understood.

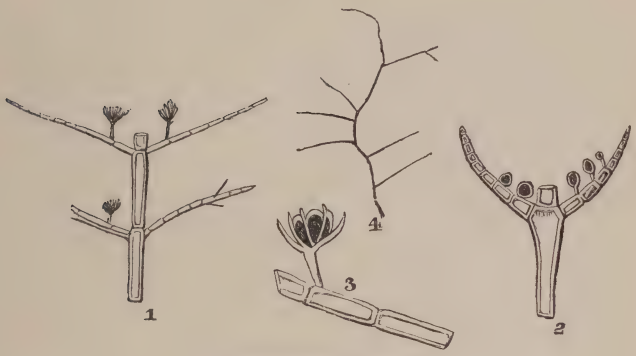
We have never met with the normal form of the species in a living state, but have been amply supplied with specimens from the Isle of Wight and other parts in the south of England. These are abundantly fruited, whilst others which we refer to *C. repens* are all barren. We cannot take this, however, as an evidence of their being young or imperfectly developed, as they are often much larger than the fruited ones. All our Forfarshire specimens are of the straggling branched variety, and although barren, sometimes reach the length of from two to two and a-half inches; in these the branching is very straggling and irregular, the branches distant, long, and often quite naked.

The two forms, therefore, have a very different aspect, and were it not in deference to so high authority, we would strongly suspect that under the present name, it may still be possible that more than one species are included.

In Forfarshire specimens, the branching is more frequently secund than alternate; sometimes the whole of the branches arise from one side, at other times two or three alternately, and occasionally they are alternate, but it never happens that all or even one-half of the articulations produce ramuli, and very rarely above one in six. These branches are generally simple, but occasionally also they again produce branchlets, short and cylindrical, but nearly of the same diameter as the one from which they spring, the whole frond being of nearly equal thickness throughout.

It seems to have rather a partiality for *Furcellaria fastigiata* and *Polyides rotundus*, but does not hesitate to attach itself to any other

Alga within reach, and seems to prefer rather deep shady rock-pools, where it can be always covered, and where it can be protected from the noon-day sun as well as the buffeting of the billows.




CALLITHAMNION TURNERI.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Plumulæ with favellæ.
2.—Plumulæ with tetraspores.
3.—Favellæ.
4.—Branch of variety β. All magnified.

## CALLITHAMNION BARBATUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *barbatum.*—"Stems (rising from creeping filaments?) much and irregularly branched; branches mostly alternate, long, subsimple, naked or pinnulated, with minute, opposite, spine-like, erecto-patent ramuli; articulations twice or thrice as long as broad; tetraspores elliptic oblong, with a wide limbus, sessile on the sides of the pinnulæ."—*Phyc. Brit.*

Callithamnion *barbatum.*—*Ag. Syst. Alg.* vol. ii. p. 181; *J. Ag. Alg. Medit.* p. 70; *Endl.* 3rd Suppl. p. 34; *E. Bot.* Suppl. t. 2889; *Harv. P. B.* plate 165; *Harv. Man.* p. 173; *Harv. Syn.* p. 144; *Atlas*, plate 56, fig. 256; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 22.

Callithamnion *Ralfsii.*—*Harv.* in *Herb.* (1838).

Hab.—On mud-covered rocks in the sea. Very rare. Perennial? Ilfracombe and on the quay at Penzance (*Mr. Ralfs*, 1838); Dredged at Weymouth (*Rev. M. J. Berkeley*).

Geogr. Dist.—Mediterranean Sea.

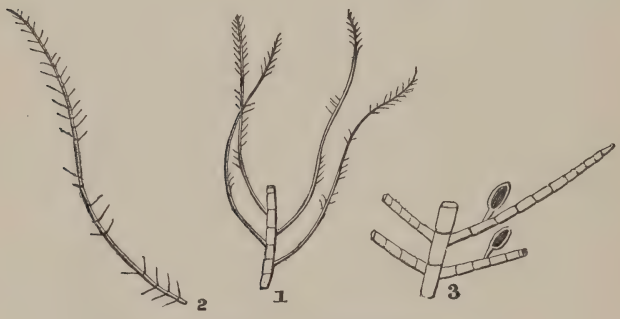
Description.—"Filaments forming intricate tufts, densely matted together at base by creeping fibres, and difficult to disentangle, one to two inches high, much and irregularly branched; branches alternate or opposite, erect, long, simple, or bearing others similar to themselves, their upper half closely pinnulated with very short, opposite, spine-like, erecto-patent ramuli; their lower part either naked or irregularly pinnulated with similar ramuli. Articulations cylindrical, twice or thrice as long as broad. Tetraspores elliptic oblong, with a very wide limbus, borne on the sides of the ramuli, sessile, mostly solitary. Favellæ unknown. Substance membranous and somewhat rigid, imperfectly adhering to paper. Colour, a dull brownish red, without gloss."—*Phyc. Brit.*

This species we have never seen, and only know it by the descriptions of authors.

In its less perfectly developed form it seems much to resemble the naked battered stems of some other species, being then almost destitute

of the ramuli, which usually feather to a greater or less extent the extremities of the branches. In this state it may be readily mistaken for *C. floridulum*, but the habit is somewhat different, as well as the length of the joints and the ramification of the main branches.

From the last species, *C. Turneri*, it may also be known by its much shorter articulations; but the principal marks of distinction lie in the fruit, which will readily distinguish it at a glance.




CALLITHAMNION BARBATUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Portion of a plant.
2.—Branch from same.
3.—Portion of plant with tetraspores. All magnified.

## CALLITHAMNION PLUMA.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *pluma*.—Stems arising from creeping fibres, erect, sparingly branched, naked below, closely pectinato-pinnate at the summits with short, rather erect, opposite ramuli; articulations about two but sometimes four times as long as broad; tetraspores terminal on abbreviated ramuli, or attached to short proper stalks near their base.

Callithamnion *pluma*.—*Ag. Sp. Alg.* vol. ii. p. 162; *E. Bot.* Suppl. t. 2894; *Endl.* 3rd Suppl. p. 34; *Kütz. Sp. Alg.* p. 647; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 340; *Harv.* in *Mack. Fl. Hib.* part 3, p. 217; *Harv. P. B.* plate 296; *Harv. Man.* p. 173; *Harv. Syn.* p. 145; *Atlas*, plate 58, fig. 267; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 25.

Callithamnion *plumula*, β *pusillum*.—*Lyngb. Hyd. Dan.* p. 127, t. 39.

Ceramium *pluma*.—*Ag. Syst.* p. 132.

Conferva *pluma*.—*Dillw. Conf.* p. 119, tab. F.

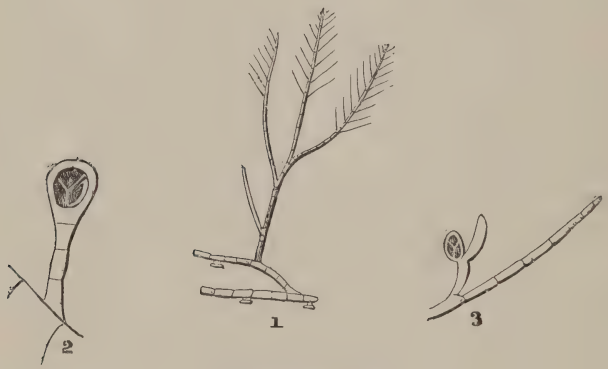
Hab.—Parasitical on the stems of *Laminaria digitata*. Not uncommon. Annual. Summer. No doubt on all our coasts.

Geogr. Dist.—Atlantic shores of Europe.

Description.—Root composed of creeping fibres, attaching itself to the stems of other plants by means of minute discs. Fronds densely tufted, erect, two to six lines or so in height, very slender, often simple, generally sparingly branched; the branches alternate, furnished at their summits with short, opposite, closely placed, pectinato-pinnate ramuli, each joint furnishing a pair, the lower ones longest, upper minute, forming an ovate plumule, which is frequently imperfect. Articulations of the stem variable, generally about twice as long as broad, those of the ramuli rather shorter, and their diameter not much less than that of the main stems, all cylindrical, apices very obtuse. "Tetraspores globose, either borne on short, proper pedicels, which rise singly or in pairs, near the base of the pinnules, or terminating a shortened pinnule."

This very pretty and very minute species is considered rather rare, but may be often overlooked on account of its small size and simple

form, rendering it very easily confounded with other species. It generally forms close velvety patches on the stems of *Laminaria digitata*, to which it is said to be most partial, and may be generally recognised by its creeping rhizome from the other species with which it is likely to be confounded, and from *C. Turneri* by the great disparity in the length of the joints. When wholly unbranched it very closely resembles *C. sparsum*, and may be distinguished by its rather stouter more rigid stems, and the larger articulations. We have seen no fruit of either kind, and presume it to be uncommon.




CALLITHAMNION PLUMA.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Portion of a plant.
2.—Terminal tetraspore.
3.—Lateral tetraspore. All magnified.

# Plate CXIX.

## CALLITHAMNION ARBUSCULA.—*Lyngb.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *arbuscula*.—Stems rather stout, naked and opaque at the base, much divided and very bushy upwards; ultimate ramuli pinnate, with alternate, mostly simple, rather long, setaceous, recurved pinnules, the upper edges of which are fringed with sessile, spherical tetraspores; articulations twice as long as broad.

Callithamnion *arbuscula*.—*Lyngb. Hyd. Dan.* p. 123, t. 38; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 340; *Harv.* in *Mack. Fl. Hib.* part 3, p. 213; *Harv. P. B.* plate 274; *Harv. Man.* p. 174; *Harv. Syn.* p. 145; *Atlas*, plate 57, fig. 262; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 60.

Phlebothamnion *arbuscula*.—*Kütz. Sp. Alg.* p. 656.

Dasya *spongiosa*.—*Ag. Sp. Alg.* vol. ii. p. 121.

Conferva *arbuscula*.—*R. Br. Dillw.* t. 85 (excl. t. G.); *E. Bot.* t. 1916.

Hab.—On mussel-shells near low-water mark, left bare by the tide. Perennial. Summer and autumn. Common on the west coasts of Scotland and Ireland. Rare on the eastern.

Geogr. Dist.—Faroe Islands.

Description.—Root, a rather large flat conical disc. Fronds very bushy, two to four inches or more in length, and from half a line to a line in diameter, naked for half an inch or an inch or more, but sometimes branched even from the base, most densely upwards, the branches spreading on all sides, longest near the base, giving the frond a conical outline, the ultimate branchlets more or less zigzag, producing at the summit of each articulation alternate, slender, simple or forked tapering pinnæ, which are patent or more or less recurved. Towards the summit the ramuli are extremely dense, giving the plant a very thick bushy appearance upwards. Substance somewhat cartilaginous in the older part, soft and flaccid in the younger, and adhering closely to paper, but when the plants become old they adhere very imperfectly. Colour, a deep brownish purple or reddish brown, darker when old. Favellæ lobed, minute, arising from the sides of the ramuli. Tetraspores numerous, fringing the upper edge of their pinnæ.

This species can scarcely be confounded with any other; its densely bushy habit and dark colour are so unlike any other species of the genus, that there can be no great difficulty in identifying it, and once seen, its characteristic features cannot well be mistaken. It has somewhat the appearance of *C. spongiosum*, but the dichotomous, not pinnated ramuli of that species, will readily identify it.

*C. arbuscula* is said to be rare in England, but not uncommon on the shores of both Scotland and Ireland. The only English specimens we have seen are from Yorkshire, where we believe it is scarce. On the rocky shores of the east of Scotland it is rather plentiful, and the fruit is not scarce, tetraspores being rather more plentiful than favellæ.

Its favourite habitat is on exposed rocks which are dry at low water, seldom growing on the rocks themselves, but on the small live mussel-shells that often form a dense covering in such localities; in some places preferring the face of the rock fronting the land, and thus as it were seeking protection from the surf which comes rolling in from without; at other times forming rough, spongy-looking tufts among *Polysiphonia urceolata*, on sloping rocks exposed to the full force of the waves, almost always growing near the summit of the rock, thus as it were appearing to prefer shallow water; yet we have never found it growing near high-water mark, and very rarely in pools where it would always be covered with water.

## EXPLANATION OF PLATE CXIX.

Fig. 1.—*Callithamnion arbuscula*, natural size.
2.—Branchlet with favellæ.
3.—Branchlet with tetraspores.
4.—Transverse section of stem.
5.—Portion of stem. All magnified.

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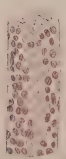

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*Callithamnion Arbuscula. Lyngb.*

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# Plate CXX.

## CALLITHAMNION BRODIÆI.—*Harv.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *Brodiæi*.—"Stem subopaque, veiny, obscurely jointed, slender, simple, furnished throughout with densely inserted, patent, lateral branches, furnished at each joint with short quadrifarious secondary branches, with a narrow hastate outline; plumules alternate subsimple, pinnate, ovate, their pinnules patent, frequently with a few secund processes near the apex; tetraspores oval, sessile near the tips of the pinnules, or on their accessary processes; favellæ bilobed on the secondary branches."—*Phyc. Brit.*

Callithamnion *Brodiæi*.—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 105; *Harv. P. B.* plate 129; *Harv. Man.* p. 174; *Harv. Syn.* p. 146; *Atlas*, plate 56, fig. 257; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 57; *Wyatt, Alg. Danm.* No. 184.

Hab.—Parasitical on Algæ, near low-water mark. Annual. Summer. Rare. Forres (*Mr. Brodie*); Northumberland coast (*Mr. Robertson*); Torquay (*Mrs. Griffiths* and *Miss Cutler*); Cornwall (*Mr. Ralfs*); Saltcoats (*Rev. D. Landsborough*).

Geogr. Dist.—British Islands?

Description.—Root, a minute spreading disc. Fronds tufted, from one to two or sometimes three inches long; main stem rather stout at the base, tapering upwards, and generally percurrent; in the older part opaque, with veins, often shaggy, with minute fibres; in the younger, more or less distinctly articulated and transparent, everywhere closely set, almost from the base, with erecto-patent branches, rather stout at their insertion, and tapering upwards, the lowest divisions always longest, giving the frond and its parts a pyramidal outline; these branches are again furnished with a similar set of branches, and these often with a third set, the ultimate branchlets being often pectinated in their upper half with a few short, secund, tooth-like processes; all the divisions are rather patent, sometimes slightly recurved. Articulations of the main branches about twice as long as broad, those of the ramuli a little

longer than broad. Substance rather firm, the older parts not adhering very firmly to paper. Colour, a dark but rather dull reddish brown, not changing much in drying. Favellæ mostly binate, roundish, lateral on the smaller ramuli. Tetraspores roundish, triparted, sessile on the upper edge of the tooth-like processes.

We have never met with this species on the east coast, and have not seen Scotch specimens; all ours are from the south of England, and are of smaller size than ordinary.

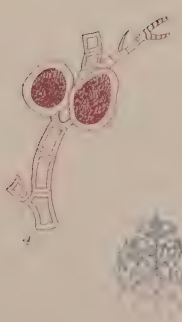
In habit it is somewhat intermediate between the last species and the following, being much less bushy than the preceding, but less so than *C. tetragonum;* it has also a close resemblance to *C. brachiatum,* but from all may be distinguished by its microscopical characters.

From the last species, *C. arbuscula,* its much less dense ramification will generally distinguish it; and from *C. tetragonum* the short, somewhat clavate plumules, taper to the base, are perhaps the best mark of distinction.

It was first discovered on the north-east coast of Scotland, by Mr. Brodie, of Brodie, and has since been observed on many other parts of the British coast, but Professor Harvey informs us that he has not seen any foreign specimens. In this country it does not seem to be uncommon, growing generally on the smaller Algæ near low-water mark, or beyond it, and occasionally in tide-pools at a less depth.

EXPLANATION OF PLATE CXX.

Fig. 1.—*Callithamnion Brodiæi,* natural size.
2.—Branchlet with tetraspores.
3.—Same, more magnified.
4.—Branchlet with favellæ.
5.—Portion of stem. All magnified.



*Callithamnion Brodiæi, Harv.*

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# Plate CXXI.

## CALLITHAMNION TETRAGONUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *tetragonum.*—Frond with a rather stout percurrent main stem, tapering, opaque at the base, three or four times somewhat quadrifariously branched, those branches near the base longest; penultimate plumules long, slender, with a linear outline, and set with alternate, short, closely pinnate or bipinnate plumules, the pinnulæ erect, incurved, thickened upwards, and shortly acuminate; articulations two to three times as long as broad, those of the pinnules once or once and a-half as long as broad; tetraspores minute, produced at the apices of the pinnulæ; favellæ on abbreviated pinnulæ.

Callithamnion *tetragonum.*—*Ag. Sp. Alg.* vol. ii. p. 176; *Wyatt, Alg. Danm.* No. 90; *J. Ag. Alg. Medit.* p. 74; *Endl.* 3rd Suppl. p. 34; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 343; *Harv.* in *Mack. Fl. Hib.* part 3, p. 215; *Harv. P. B.* plate 136; *Harv. Man.* p. 175; *Harv. Syn.* p. 147; *Atlas*, plate 57, fig. 264; *Harv. N. B. A.* part 2, p. 230; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 53.

Ceramium *tetragonum.*—*Ag. Syst.* p. 137.

Conferva *tetragona.*—*With. Br. Pl.* vol. v. p. 405; *Dillw. Conf.* t. 65; *E. Bot.* t. 1690.

Hab.—Parasitical on the *Laminariæ*. Annual. Summer. Common. Shores of England and Ireland. Rare in Scotland. Arran and Ayrshire coasts (*Rev. D. Landsborough*).

Geogr. Dist.—Atlantic shores of Europe; Baltic and Mediterranean Seas.

Description.—Root, a flattened, conical, spreading disc. Fronds with the main stem rather stout and percurrent, at length more or less pervaded by opaque veins or jointed filaments, and in age becoming more or less covered with short branching pile, and beset from near the base with scattered, rather patent branches of very irregular length, from that of the short pile which covers the stem, to that of two or two and a-half inches; these are again once or twice branched in a similar manner, the ultimate branchlets regularly set with very short and rather

regularly pinnated plumules; the pinnæ rather erect, and somewhat incurved, thickened upwards, and tapering to the base, with very short, acute apices. Articulations of the stem and branches two to three times as long as broad, those of the ramuli once or once and a-half, each generally producing a branchlet at its apex. Substance rather firm and subcartilaginous, scarcely adhering to the paper, even in its younger part. Colour, a deep dark brownish purple. Favellæ bilobed, roundish oval, terminal on abbreviated plumules. Tetraspores roundish oval, sessile on the upper edge, and mostly near the apices of the plumules.

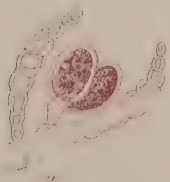
A very fine species, and not difficult to understand, being easily known by its long slender branches and short closely plumose ramuli, thickened almost to the penultimate joint, and then suddenly acuminated or rather acute.

We have not met with it on the east coast; the species, however, seems to be pretty generally distributed, and appears to be not uncommon on the south-west of England as well as on most of the Irish coasts, and on the Continent extends from the shores of the Baltic to those of the Mediterranean.—*Phyc. Brit.*

It seems very partial to the fronds of *Laminaria digitata*, but grows also on those of *Polyides rotundus*, *Chondrus crispus*, and perhaps many others. Of the large fronds of the first it often fringes the margin from end to end, and the paler greenish brown of the frond is finely contrasted with the deep reddish brown of the rich and delicate border.

EXPLANATION OF PLATE CXXI.

Fig. 1.—*Callithamnion tetragonum*, natural size.
2.—Pinna with tetraspores.
3.—Tetraspore from same.
4.—Pinnæ with favellæ.
5.—Portion of stem. All magnified.



*Callithamnion tetragonum, Ag.*

# Plate CXXII.

## CALLITHAMNION BRACHIATUM.—*Bonnem.*

Gen. Char.—Fronds filiform and articulated, sometimes at length, in the older parts cellular and partially opaque, single-tubed ; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants : 1. Favellæ, mostly lateral on the branches, and filled with minute spores ; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *brachiatum.*—"Outline of the frond lanceolate ; stem cartilaginous, subsimple, setaceous, somewhat opaque, veiny, set with subquadrifarious, lateral branches, often furnished with a second series, penultimate ; branches pellucidly jointed, slender, elongate, set with short alternate, very erect, level topped plumules, the lowermost of which are most simple ; ramuli erect, subulate, not narrowed at the base, gradually tapering to a fine point, their articulations twice as long as broad, cylindrical ; tetraspores minute, oval, near the tips of the ramuli."

Callithamnion *brachiatum.*—*Bonnem.* (sec. *Lenorm.* in *Herb.*) ; *Harv. P. B.* plate 137 ; *Harv. Man.* p. 175 ; *Harv. Syn.* p. 147 ; *Atlas*, plate 56, fig. 258.

Callithamnion *hirtum*, var. β.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 54.

Callithamnion *Harveyanum.*—*J. Ag.* in *Linn.* vol. xv. p. 45 ; *Endl.* 3rd Suppl. p. 34.

Callithamnion *granulatum.*—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 334 (not of *Agardh*) ; *Harv.* in *Mack. Fl. Hib.* part 3, p. 215.

Hab.—Parasitical on the *Laminariæ*, &c. Not uncommon.

Geogr. Dist.—Atlantic shores of Europe.

Description.—Root, a minute conical disc. Fronds rather stout at the base, tapering upwards to a fine point, tufted, one and a-half to three inches long or more. Stem percurrent, beset almost from the base with subquadrifarious or scattered, erecto-patent branches, those near the base longest, giving the frond an acutely ovate or somewhat lanceolate outline ; these are either simple or, in very luxuriant specimens, furnished with a second or rarely and partially even with a third series of similar branches, and these produced at the apex of every joint with a short corymbose plumule, consisting at the base of a simple spine-like ramulus, upwards of from three to six, which are erect, somewhat incurved, thickest at the base, and gradually taper to a fine point, the dissepi-

ments not contracted, and articulations not inflated in the middle. Substance somewhat flaccid, more or less adhering to paper. Colour, a rather bright brownish red. Favellæ "roundish ovate at the tips of shortened plumules." Tetraspores elliptical on the upper edge and near the tips of the plumules.

This species, it will be seen, differs chiefly from the preceding by its somewhat smaller size, brighter colour, and particularly by the form of the plumules, and their articulations. These, instead of being thickened upwards, are thickest at the base, and gradually taper upwards to a point; and the articulations, instead of being inflated in the middle and contracted at the dissepiments, are nearly cylindrical, the dissepiments not at all contracted. These characters, although not very difficult to recognise in practice, will, we fear, be generally considered somewhat unsatisfactory for specific distinction. The species, however, has been very generally recognised by observers, and that in several cases independently of each other, and it is pretty constant to its characters. In habit it is almost identical with that of the preceding, and we find it often in collections under its name; the place of growth of both species is the same. We have not found it on the east coast, but on the west it is not unfrequent, as far north as the Orkney Islands, but more abundant on the south-western shores.

EXPLANATION OF PLATE CXXII.

Fig. 1.—*Callithamnion brachiatum*, natural size.
2.—Pinnæ with tetraspores.
3.—Pinnule from same.
4.—Pinnæ with favellæ. All magnified.

*Callithamnion brachiatum*, Bonn.

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# Plate CXXIII.

## CALLITHAMNION TETRICUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *tetricum.*—Fronds with a stem rather stout at the base, and shaggy, tapering upwards to a point, much branched from the base; all the branches covered with plumulate ramuli, which are either simply or doubly pinnate; pinnæ cylindrical, tapering at the base and apex, bearing on the upper joints short, recurved, spine-like pinnules, on which the tetraspores are placed.

Callithamnion *tetricum.*—*Ag. Sp. Alg.* vol. ii. p. 179; *Wyatt, Alg. Danm.* No. 141; *Endl.* 3rd. Suppl. p. 34; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 342; *Harv.* in. *Mack. Fl. Hib.* part 3, p. 214; *Harv. P. B.* plate 188; *Harv. Man.* p. 176; *Harv. Syn.* p. 148; *Atlas,* plate 56, fig. 259; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 52.

Phlebothamnion *tetricum.*—*Kütz. Phyc. Gen.* p. 374.

Conferva *tetrica.*—*Dillw.* t. 81; *E. Bot.* t. 1915.

Hab.—On rocks from half-tide level to low-water mark. Perennial. Summer. Common on the shores of the south of England, and south-west of Ireland—less frequent on the east coast. Lambay (*Mr. M'Calla*); Channel Islands.

Geogr. Dist.—Northern coasts of France.

Description.—Root, a large flat conical disc, densely covered with minute fibres. Frond much tufted, two to five inches or more in length, and from half a line to one and a-half in thickness at the base, tapering upwards, and repeatedly divided; all the main divisions more or less shaggy, especially towards the base, with short, simple, or somewhat elongated, slightly branched fibres; ultimate ramuli pinnate, pinnæ alternate, rather long, cylindrical in the middle, tapering near the base and apex, suberect or somewhat patent, of nearly equal length, giving the plumule a linear appearance. Articulations about twice or thrice as long as broad, those of the pinnæ a little longer than broad, almost cylindrical or very slightly inflated. Substance harsh and rigid, very imperfectly adhering to paper. Colour, a dull sometimes dark reddish

brown, without gloss, soon given out in fresh water. Favellæ "binate, borne on the pinnæ (frequently shortened) of less regular plumules." Tetraspores roundish ovate, tripartite, produced on the upper edges of the tooth-like pinnules, which are placed alternately near the summits of the pinnæ.

One of the largest and coarsest of our British *Callithamnions*, as well as one of the most common on the south and south-west of both England and Ireland. It seems, however, to be an ocean species, and is rarely, if at all, a native on our eastern shores.

Its favourite habitat seems to be the perpendicular faces of rocks which are generally left bare at low water, and where it often hangs in large shaggy festoons of several inches in length, and of a peculiar rusty brown colour, more or less deepening into a dark brownish black when moist, but paler and more apparent when dry.

The species seems to be perennial, and, like all such, exhibits very different aspects at different seasons, and in different situations—at one time presenting little else than naked battered stems, while at another these become covered with long, slender, and delicate plumules of a brighter colour, but the ochry tint is always more or less apparent, and very characteristic of the species. The pinnæ are often very imperfectly developed, especially on those specimens that produce favellæ.

EXPLANATION OF PLATE CXXIII.

Fig. 1.—*Callithamnion tetricum*, natural size.
2.—Pinnule with tetraspores.
3.—A tetraspore from same.
4.—Pinnule with favellæ. All magnified.

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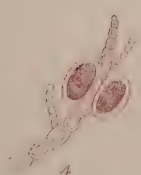

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*Callithamnion tetricum fig.*

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# Plate CXXIV.

## CALLITHAMNION HOOKERI.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *Hookeri.*—Stem rather slender, tapering and percurrent, the articulations rendered obsolete near the base by longitudinal veins, distinctly apparent upwards, somewhat alternately branched; the branches simple or again divided, all naked below, bi-tripinnated upwards; pinnæ and pinnules rather patent; articulations from one and a-half to two and a-half times as long as broad.

Callithamnion *Hookeri.—Ag. Sp. Alg.* vol. ii. p. 179; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 341; *Harv. P. B.* plate 279; *Harv. Man.* p. 176; *Harv. Syn.* p. 148; *Atlas*, plate 58, fig. 266; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 51.

Callithamnion *lanosum.—Harv.* in *Hook. Br. Fl.* vol. ii. p. 341; *Wyatt, Alg. Danm.* No. 139.

Callithamnion *spinosum.—Harv.* in *Hook. Br. Fl.* vol. ii. p. 345; *Harv. Man.* 1st ed. p. 111.

Phlebothamnion *Hookeri.—Kütz. Phyc.* p. 375; *Sp. Alg.* p. 653.

Phlebothamnion *spinosum.—Kütz. Sp. Alg.* p. 653.

Ceramium *Hookeri.—Ag. Syn.* p. 27; *Hook. Fl. Scot.* part 2, p. 85; *Ag. Syst.* p. 138.

Conferva *Hookeri.—Dillw. Conf.* t. 106.

Hab.—On Algæ, and on rocks between tide-marks, and in deep water. Annual. Summer. Common.

Geogr. Dist.—Atlantic shores of Europe.

Description.—Root, a minute conical disc. Fronds densely tufted, one to three inches or more in length, very slender, and slightly tapering, much branched; branches somewhat scattered or alternate, rather patent, once or twice again branched in a more or less distichously pinnate or bipinnate manner upwards, the bases generally naked for about one-third; all the divisions more or less patent, the ultimate pinnæ often recurved. Articulations from one and a-half to two and

a-half times as long as broad, rendered very indistinct towards the base by numerous longitudinal articulated veins, densest near the base of the branches, where they appear to originate, proceeding spirally downwards; in the upper parts of the branches and ramuli they are free from veins and quite transparent, one to one and a-half times as long as broad. Substance rather flaccid and tender, closely adhering to paper in drying. Colour, a rather bright somewhat brownish red, very deliquescent in fresh water. Favellæ "binate, mostly terminal on less regularly pinnate branches." Tetraspores produced on the upper edge of the pinnulæ, roundish ovate, sessile, tripartite.

We are indebted for the discovery of this very pretty species to the acute observation of Sir W. Jackson Hooker. Its most characteristic features are its opaque stem, by which it is readily distinguished from *C. polyspermum* and *C. Borreri*, its short articulations and the naked bases of the branches, which will generally separate it from *C. roseum;* the ramuli or pinnæ of that species are also more elongated and more simple. From *C. affine* it differs in the length of the articulations, and the direction and ramification of the branches.

The species is very generally distributed along our western shores, but appears to be less common on the eastern, occasionally passed over, as we may suppose it to be, for its more common allies *C. roseum* and *C. polyspermum.*

EXPLANATION OF PLATE CXXIV.

Fig. 1.—*Callithamnion Hookeri*, natural size.
2.—Pinnule with tetraspores.
3.—Tetraspore from same.
4.—Favellæ.
5.—Portion of stem. All magnified.

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2

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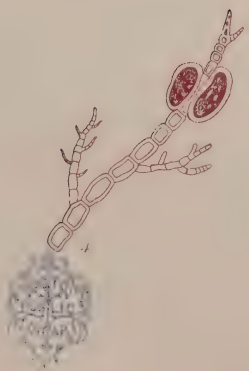

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*Callithamnion Hookeri*, Dillw.

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# Plate CXXV.

## CALLITHAMNION ROSEUM.—*Lyngb.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *roseum.*—Fronds slender, opaque at the base, much branched; branches distichous, irregularly alternate, ultimate branchlets pinnate or bipinnate, long and tapering; articulations four to five times as long as broad below, and obscured by veins, above much shorter and transparent; favellæ clustered near the apices of the pinnæ; tetraspores numerous on the upper edge of the pinnæ.

Callithamnion *roseum.*—*Lyngb. Hyd. Dan.* p. 126, t. 39; *Ag. Sp. Alg.* vol. ii. p. 164; *Wyatt, Alg. Danm.* No. 44; *Endl.* 3rd Suppl. p. 34; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 341; *Harv.* in *Mack. Fl. Hib.* part 3, p. 214; *Harv. P. B.* plate 230; *Harv. Man.* p. 177; *Harv. Syn.* p. 149; *Atlas*, plate 56, fig. 260; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 36.

Phlebothamnion *roseum.*—*Kütz. Phyc. Gen.* p. 375, t. 44, f. 1.

Ceramium *roseum.*—*Roth, Cat. Bot.* vol. iii. p. 145; *Ag. Syst.* p. 139.

Conferva *rosea.*—*E. Bot.* t. 966.

Hab.—On rocks and the larger Algæ in æstuaries or muddy places near low-water mark. Annual. Summer. Common.

Geogr. Dist.—Atlantic shores of Europe.

Description.—Root, a minute disc, when old often covered by fibres. Stems rather slender, two to four inches long, tapering upwards, opaque at the base, filled with veins when old, and sometimes more or less covered with short branching pile, much branched from the base; branches erecto-patent, once or twice again divided in a subdistichous and alternate manner, regularly pinnated upwards; pinnæ and pinnules long, slender, rather distant, one from the apex of each articulation, tapering from the base to the point, the rachides flexuose, pinnules incurved. Articulations nearly cylindrical, or slightly contracted towards the middle, below four to six times as long as broad, and more or less filled with veins which arise from the bases of the branches, and descend spirally downwards, rendering the articulations more or less opaque; in

the upper part these veins are wanting, and the articulations are distinct, and gradually become shorter upwards. Substance rather soft and flaccid, and adhering, but not very firmly, to the paper. Colour, a rather bright purplish lake, but often changing to a reddish or even yellowish brown, without gloss. Favellæ clustered at or near the apices of abbreviated branchlets, spores large, angular. Tetraspores numerous, arranged along the upper edge of the pinnules, roundish oval, sessile and triparted.

*C. roseum* is one of our most common species, being very generally distributed all round the British shores, and is equally abundant on the east and on the west coasts, growing sometimes in great abundance on rocks that are bare at low water, or occasionally at greater depths, generally, however, attached to the smaller Algæ, such as *Ceramium*, *Cladostephus*, &c., generally growing in separate tufts, but these often cover a considerable extent of surface. We have sometimes seen it forming a dense covering on the roofs of small submarine hollows or caves, the fronds brushed down in fine crossing tessellated ridges, so as to resemble the woodwork on the roofs of cathedrals, &c.

Its principal characters are found in its long joints, opaque stems, and slender pinnæ, by which it is not generally difficult to distinguish it from its allies. In specimens that have never been exposed to the atmosphere, the colour is generally a fine clear lake, but the action of the air soon changes the colour to a more or less yellowish brown, and specimens may be often seen with the exposed parts brown, and the under parts still retaining their original purple colour.

EXPLANATION OF PLATE CXXV.

Fig. 1.—*Callithamnion roseum*, natural size.
2.—Pinnule with tetraspores.
3.—Tetraspore from same.
4.—Pinnæ with favellæ.
5.—Portion of stem. All magnified.

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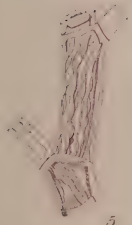

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*Callithamnion Roseum, Lyngb.*

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## CALLITHAMNION BYSSOIDEUM.—*Arn.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *byssoideum*.—Fronds very slender, soft, and byssoid, much branched from the base; branches long, slender, and flexuous, once or twice alternately pinnate, pinnæ and pinnules very slender, more or less flexuous and tapering; articulations cylindrical, six to eight times longer than broad, shorter upwards; "tetraspores one or two, sessile on the pinnules;" favellæ "binate, subterminal."

Callithamnion *byssoideum*.—*Arnott MSS.*; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 342; *Wyatt, Alg. Danm.* No. 185; *Harv. P. B.* plate 262; *Harv. Man.* p. 178; *Harv. Syn.* p. 149; *Atlas*, plate 58, fig. 269; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 40.

Hab.—On several Algæ (especially *Codium tomentosum*), in tide-pools near low-water mark. Not uncommon on the English and Irish coasts. Rare in Scotland.

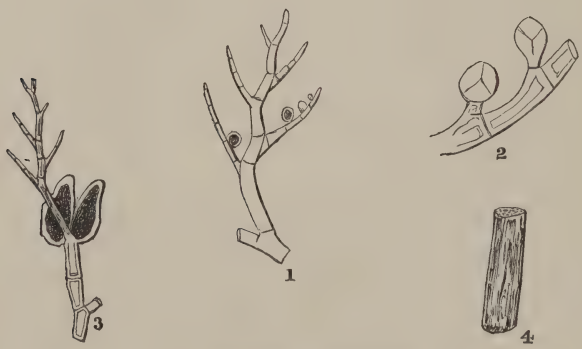
Geogr. Dist.——?

Description.—Root——? Fronds densely tufted, excessively slender and delicate, from one to three inches long, much branched; branches distichous, repeatedly pinnate, alternate, distant, more or less flexuous, and gradually tapering to a point, erecto-patent, longest in the middle or near the base, giving the frond or branch an ovate or broadly lanceolate outline; generally every joint produces its ramulus, but in the larger branches the lowest joint or sometimes two are naked; the pinnæ and pinnules are more or less incurved, the pinnules simple upward, but sometimes the lower ones have a few irregular ramuli. Articulations of the stem and branches cylindrical, five, eight, or even more times longer than broad, shorter upwards, and quite transparent, those at the base of the stem only, partially filled with veins. Substance extremely flaccid and delicate, closely adhering to paper in drying. Colour, "a fine rosy lake, with a slightly purple or sometimes brown hue." Favellæ "binate, generally terminating truncated branches." Tetraspores "elliptical, sessile, rather large, borne on the sides of the pinnules, towards the base, one or two, rarely more, on each pinnule."—*Phyc. Brit.*

With this very delicate species we are but only imperfectly acquainted,

and have not seen specimens in fruit of either kind. It is said to be very nearly allied both to *C. corymbosum* and *C. roseum*, but to be abundantly different from both. From *C. corymbosum* its regularly pinnate ramification will readily distinguish it, and from *C. roseum* the extreme delicacy of the filaments, the much greater proportionate length of the articulations, and fewer tetraspores, will generally be sufficient to distinguish it.

We have seen no Scotch specimens, nor any from the east coast of England. On the southern shores of England and Ireland it seems to be less rare, and may be not uncommon, as it is very likely to be often overlooked by its close resemblance to other more common species. The best *primâ facie* character may perhaps be found in the great tenuity of the filaments, and the unusual length of the articulations, which renders it soft and even lubricous to the touch compared with its near ally *C. roseum*.




CALLITHAMNION BYSSOIDEUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet with tetraspores.
2.—Tetraspores from same.
3.—Branchlet with favellæ.
4.—Portion of stem.—*Phyc. Brit.* All magnified.

## CALLITHAMNION POLYSPERMUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *polyspermum.*—Fronds rather slender and delicate, much tufted and irregularly branched, distichous, and repeatedly pinnate upwards; pinnæ long, slender, and scarcely tapering, pinnules short, subulate, slightly recurved; articulations of the main branches four to five times longer than broad, shorter upwards.

Callithamnion *polyspermum.*—*Ag. Sp. Alg.* vol. ii. p. 169; *Wyatt, Alg. Danm.* No. 140; *Endl.* 3rd Suppl. p. 34; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 342; *Harv.* in *Mack. Fl. Hib.* part 3, p. 214; *Harv. P. B.* plate 231; *Harv. Man.* p. 178; *Harv. Syn.* p. 150; *Atlas*, plate 58, fig. 270; *Harv. N. B. A.* part 2, p. 234; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 48.

Callithamnion *Grevillii.*—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 345; *Harv. Man.* 1st ed. p. 110; *Harv.* in *Mack. Fl. Hib.* part 3, p. 215.

Callithamnion *roseum.*—*Grev. Fl. Edin.* p. 311 (not of *Br. Fl.*).

Callithamnion *purpurascens.*—*Johnst. Berw. Fl.* vol. i. p. 240.

Phlebothamnion *polyspermum.*—*Kütz. Phyc. Gen.* p. 374.

Hab.—On *Fucus vesiculosus* and *serratus*, as well as other Algæ, between tide marks. Annual. Summer. Common.

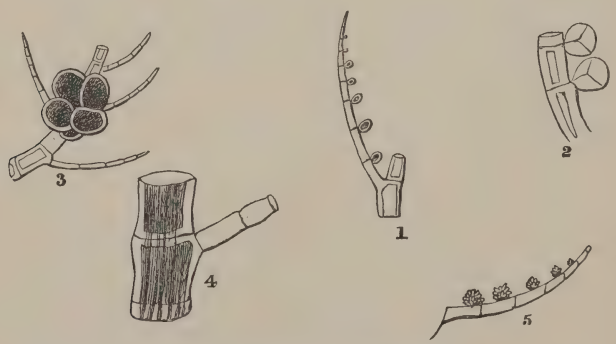
Geogr. Dist.—Atlantic shores of Europe.

Description.—Root, a minute disc. Stems very slender, much tufted, one to two or three inches in length, very much branched; lower branches somewhat irregular and scattered, long, slender, and flexuous, more regularly distichous upwards, and two to three times pinnate; pinnæ long, slender, and flexuous, scarcely tapering; pinnulæ short, recurved, subulate, of nearly equal length, giving the pinnæ a narrow, linear lanceolate outline. Articulations of the branches three to four times longer than broad, gradually shorter upwards; those at the base of the stem having a few jointed fibres proceeding from the bases of the lower branches, but not so numerous as to render the joints indistinct or opaque; those upwards entirely free from fibres, somewhat contracted at the dissepiments and in the middle. Substance very flaccid, and adhering closely to paper. Colour, a fine brownish lake,

soon given out in fresh water. Favellæ clustered, attached to the pinnæ, which are thereby distorted. Tetraspores triparted, spherical, sessile on the upper side of the pinnules. Globose tufts, composed of extremely slender filaments, formed of numerous minute articulations, are not unfrequent, occupying the same position as the tetraspores, and have been considered antheridia (?) or rather viviparous tetraspores.—*Phyc. Brit.* tab. 231.

A very common, but by no means equally satisfactory species, many of its supposed forms being so difficult to determine, that we feel very apt to hesitate in their determination. We have never seen the pinnæ and pinnules so regular, nor feathered so close to the base as in the presumed normal type, but in general it may be distinguished from *C. roseum* by its much shorter pinnules and shorter joints, which, at the base of the stem, are nearly free from internal fibres; to *C. Hookeri* it is still more closely allied, but the shorter pinnæ and pinnules, with the much more distinctly opaque stem of that species, will generally be sufficiently characteristic.

The present species is both parasitical and rupestral, and seems most partial to the larger littoral fuci, especially *F. serratus* and *vesiculosus*, on which it frequently forms dense tufts or patches of considerable extent. Both kinds of fruit are common, but seldom so plentifully produced on the specimens as they are generally represented in figures and descriptions.




CALLITHAMNION POLYSPERMUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Ramule with tetraspores.
2.—Tetraspores from same.
3.—Pinnæ with favellæ.
4.—Portion of stem.
5.—Antheridia ? All magnified.

## CALLITHAMNION FASCICULATUM.—*Harv.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *fasciculatum*.—"Tufted; branches erect, flexuous and level topped; plumules elongate, erect, linear-obovate, truncate; pinnæ long and flexuous, the lowermost simple, appressed, the upper erecto-patent, branching toward the tip; articulations of the branches veiny, thrice as long as broad, of the pinnæ once or twice as long as broad, with contracted dissepiments."—*Phyc. Brit.*

Callithamnion *fasciculatum*.—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 343; *Harv. P. B.* plate 308; *Harv. Man.* p. 179; *Harv. Syn.* p. 151; *Atlas*, plate 58, fig. 271; *Kütz. Sp. Alg.* p. 652; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 49.

Hab.—At Yarmouth (*Mr. Borrer*). In Herb. Hooker.

Geogr. Dist.—— ?

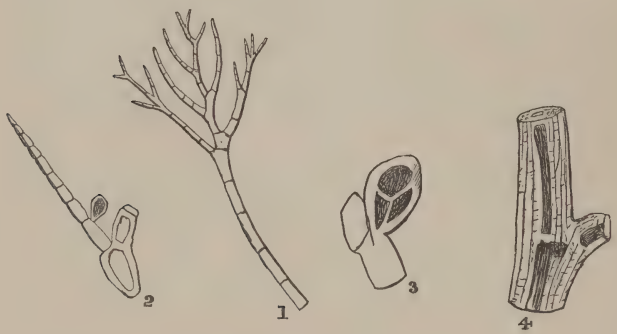
Description.—Fronds much tufted, nearly naked below and very slender and capillary, much branched and bushy upwards, the apices of the branches looking, to the naked eye, as if truncated or corymbose; branches long and slender, somewhat flexuose, erect, and cylindrical, their upper half closely plumulate; plumules long with a linear spathulate or linear obovate outline, the pinnæ of the lower half quite simple, erect and cylindrical, their apices acute, those of the upper part naked for the lower two-thirds of their length; the rest is regularly pinnate or bipinnate. Articulations of the main branches three to four times as long as broad; those of the pinnules a little longer than broad, constricted at the dissepiments, those of the stems more or less filled with jointed fibres, but scarcely obscuring the articulations. Favellæ unknown. Tetraspores elliptical, mostly solitary near the base of the pinnules. Substance rather flaccid, closely adhering to paper. Colour, a fine purplish red.

Of this curious and apparently unique species, we know nothing beyond what has been written of its characters from the solitary specimen picked up on the shore at Yarmouth by Mr. Borrer, and preserved

in the Hookerian herbarium, and our figures and description have been mostly drawn from the *Phycologia Britannica*, where the species or form is carefully delineated.

With the habit of *C. corymbosum* it is described as having the microscopical characters of *C. Borreri*, the constricted joints of the pinnæ being very characteristic of the species.

Its title to specific distinction seems fully as well founded as its right to be considered a native of Britain, as no subsequent observer has ever met with it, but whether an accidental form, or a stray waif from some unexplored shore, cannot at present perhaps be determined.




CALLITHAMNION FASCICULATUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Upper pinnæ.
2.—Pinnule with tetraspore.
3.—Tetraspore from same.
4.—Portion of stem. All magnified.

# Plate CXXVI.

## CALLITHAMNION BORRERI.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *Borreri.*—Frond much tufted and branched; branches mostly distichous, regularly pinnated with alternate plumules, the lower half of which is naked, the upper simply pinnate, with alternate pinnæ, those next the base longest. Articulations of the branches two to five times as long as broad, those of the pinnæ nearly twice as long as broad.

Callithamnion *Borreri.—Ag. Sp. Alg.* vol. ii. p. 170; *Endl.* 3rd Suppl. p. 34; *Kütz. Phyc. Gen.* p. 372; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 344; *Harv. P. B.* plate 159; *Harv. Man.* p. 179; *Harv. Syn.* p. 151; *Atlas*, plate 59, fig. 272; *Harv. N. B. A.* part 2, p. 233; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 49.

Callithamnion *seminudum.—Ag. Bot. Zeit.* 1827, p. 637; *Ag. Sp. Alg.* vol. ii. p. 167; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 344; *Wyatt, Alg. Danm.* No. 187; *J. Ag. Alg. Medit.* p. 72; *Endl.* 3rd Suppl. p. 34.

Ceramium *pinnulatum.—Ag. Syst.* p. 139.

Ceramium *miniatum.—Ag. Syst.* p. 141.

Conferva *Borreri.—Sm. E. Bot.* t. 1741.

Hab.—On mud-covered rocks near low-water mark. Annual. Summer. South of England and east of Ireland. Common. Yarmouth (*Mr. Borrer*).

Geogr. Dist.—Atlantic shores of France and Spain; Mediterranean and Adriatic Seas.

Description.—Fronds densely tufted, one to three inches long or more, very slender and capillary, much branched; the branches alternate, subdistichous, rather long and slender, naked below, the upper part repeatedly pinnate in a distichous, alternate manner, the ultimate ramuli plumose, naked in their lower part, the upper part from one to two-thirds of their length regularly and alternately pinnate; pinnæ next the base long, tapering to a point, erecto-patent, the apical ones very short, tooth-like. Articulations of the stem three to five times longer than broad, of the pinnæ once and a-half or twice as long as broad, cylindrical, scarcely contracted at the dissepiments; lower part of the

stem without veins, quite pellucid. Tetraspores roundish, sessile on the upper edge of the pinnæ, "sometimes containing eight grains, each of which at maturity separates into four pieces (and becomes a tetraspore?)" (*Phyc. Brit.*); and, on some individuals, the place of tetraspores is supplied by clusters of hyaline cells, collected in dichotomous threads, which are supposed to be antheridia. Substance rather flaccid, and adhering to the paper. Colour, a fine reddish pink, brownish or yellowish at the base. Favellæ bilobed, sessile near the apices of the plumules.

This fine species seems to be not unfrequent on the south and south-western shores of England, and may ultimately be found more generally distributed than it has hitherto been considered, when its characters and relations are better understood.

From *C. roseum* it differs chiefly in the arrangement of the pinnules, and in the veins with which the stems of these two species are more or less pervaded, and from *C. tripinnatum* chiefly by the more entirely pinnated plumules, and the solitary pinnules at the base of the pinnæ.

In our Plymouth specimens, the pinnæ are often simple, long, and slender, at other times one, two, or three pinnules are present, and sometimes these approach nearer to the base than what would be admitted to be normally characteristic of the species.

This species has been named in honour of W. Borrer, Esq. of Henfield, Sussex, to whom we are indebted for the discovery of this as well as of many other valuable additions to British botany.

EXPLANATION OF PLATE CXXVI.

Fig. 1.—*Callithamnion Borreri*, natural size.
2.—Plumule.
3.—Pinna with tetraspores.
4.—Tetraspore from same.
5.—Plumule with favellæ.
6.—Portion of stem.
7.—Portion of pinna with antheridia. All magnified.

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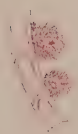

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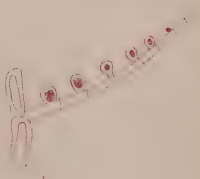

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*Callithamnion Borreri*, Ag.

Nature-Printed by Henry Bradbury.

## CALLITHAMNION AFFINE.—*Harv.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *affine*.—"Much branched and bushy, the stem rather opaque, full of veins; secondary branches long, having a roundish outline, alternately plumulate; plumules very narrow, simply pinnate; pinnæ short, erect, increasing in length upwards, alternate, crowded at top; articulations of the branches three or four times, of the pinnæ once and a-half as long as broad; tetraspores generally solitary, rising from the basal cells of the pinnæ."—*Phyc. Brit.*

Callithamnion *affine*.—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 344; *Harv. P. B.* plate 331; *Harv. Man.* p. 180; *Harv. Syn.* p. 152; *Atlas*, plate 59, fig. 273.

Hab.—Parasitical on *Fuci*, between tide-marks. Annual. Summer. Shores of Bute (*Dr. Greville*).

Geogr. Dist. ——?

Description.—Fronds much tufted, two to three inches high, rather slender, and tapering upwards; main stem mostly percurrent, opaque at the base, with veins, transparent and free from veins towards the summit, much branched from the base; branches again once or twice divided, and regularly bi-tripinnated, the pinnæ long, slender, and suberect, pinnules short, subulate, rather longer upwards, very erect, and gradually tapering to a fine point, scarcely incurved; occasionally some of the pinnules become elongated, and again pinnated. Articulations of the main branches three or four times as long as broad; those of the pinnules about once and a-half. Substance soft and delicate, adhering closely to paper. Colour, a fine clear deep lake. Tetraspores "globose, mostly solitary, at or near the base of the pinnules." Favellæ "in pairs, on slightly distorted branches, each favella occupying the place of a suppressed ramulus."—*Phyc. Brit.*

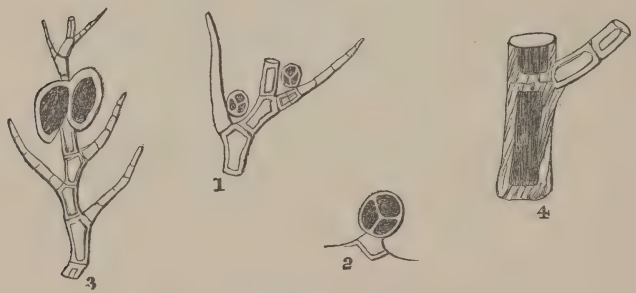
This is at least a very doubtful species, and although, when we compare it with normal forms of its allies, it certainly appears sufficiently

distinct from them all, yet there are so many intermediate forms, and these species verge into each other so frequently, that we should not wonder if the present should ultimately lose its rank as a species, and be glad to put up with that of a variety.

We have not seen any well authenticated specimens, and none in fruit, and prefer giving the characters of the species as given in *Phycologia Britannica* to any we could form from doubtful specimens.

From *C. roseum* it seems to differ in its short, erect pinnules, increasing in length upwards, and the same characters, together with the solitary tetraspores, separate it from *C. polyspermum*.

We are not aware that any really well authenticated specimens of *C. affine* have been met with since its discovery on the shores of Bute by Dr. Greville.




CALLITHAMNION AFFINE.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Branchlet with tetraspores.
2.—Tetraspore from same.
3.—Branchlet with favellæ.
4.—Portion of stem. All magnified.

## CALLITHAMNION TRIPINNATUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *tripinnatum.*—"Frond distichously branched, capillary, decomposito-pinnate; plumules elongate obovate, tripinnate above; upper pinnæ elongate and pinnulate, lower short or abortive, each pinnule having at its axil a minute pinnule; pinnules long, setaceous; joints of the stem three to four times, of the pinnæ about twice as long as broad; tetraspores oval, lateral on the axillary, and occasionally on the other pinnules."—*Phyc. Brit.*

Callithamnion *tripinnatum.*—*Ag. Sp. Alg.* vol. ii. p. 168; *J. Ag. Alg. Medit.* p. 72; *Endl.* 3rd Suppl. p. 34, No. 23 (but not of *Harv.* in *Hook. Br. Fl.* vol. ii. p. 346, nor of *Wyatt, Alg. Danm.* p. 186); *Harv. P. B.* plate 77; *Harv. Man.* p. 180; *Harv. Syn.* p. 152; *Atlas*, plate 56, fig. 261; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 46.

Mertensia *tripinnata.*—*Gratel. MS.* sec. *Ag.*

Hab.—On marine rocks, at extreme low-water mark. Annual. April, May. Very rare. Roundstone Bay (*Mr. M'Calla*); Plymouth (*Mr. Rohloff*).

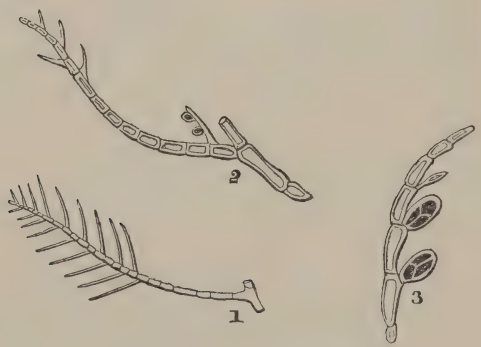
Geogr. Dist.—Coast of France; Grateloup; Mediterranean Sea (*J. Agardh*).

Description.—Fronds tufted, one to two inches high, very slender and capillary, membranaceous not gelatinous, perfectly distichous, mostly tripinnate; pinnæ acutely obovate or lanceolate, alternately pinnulate, the lower pinnules short, mostly simple or with a single pinnule above at the base, all cylindrical, tapering to a fine point; the lower half of the upper pinnules naked, the upper half again pinnate, with long, slender, alternate pinnæ, shorter upwards, and tapering to a point; at their base on the upper edge is a solitary short pinna similar to that on the lower pinnulæ. Articulations of the stem and branches from three to four times longer than broad, nearly cylindrical or slightly contracted in the middle; those of the upper divisions about twice as long as broad. Favellæ appear to be unknown. Tetraspores oval, with wide borders, secund along the edge of the ultimate pinnules, and most frequently on the small solitary pinnæ at the base. Substance delicately membranous,

and closely adhering to the paper in drying. Colour, a fine deep transparent lake.

With this beautiful species we are but very imperfectly acquainted, having only seen some very imperfect specimens from the Continent, and we have preferred giving the specific characters as given in *Phycologia Britannica*, to any we could form from fragmentary specimens. We have not seen any native specimens, and in this country it appears to be very rare, and, so far as we are aware, only found on the Irish shores.

From *C. Borreri*, to which it seems most nearly allied, it differs chiefly in having the branching more perfectly distichous, and the naked bases of the pinnules interrupted by the solitary, spine-like, generally fertile ramulus on the upper edge at the base, and in the tetraspores being generally confined to these ramuli, or at most to a few of the lower pinnulæ. Its distribution along the Atlantic shores of the Continent, as well as in the Mediterranean, would induce the hope that it may yet be found on the south-west of England, and in the Channel Islands.




CALLITHAMNION TRIPINNATUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—A plumule.
2.—One of the smaller pinnæ.
3.—A pinnule with tetraspores. All magnified.
*Phyc. Brit.*

## CALLITHAMNION GRACILLIMUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *gracillimum.*—Fronds tufted, much branched distichously, capillaceous, tapering, decomposito-pinnate; pinnæ alternate, erecto-patent; articulations nearly cylindrical, those of the stem three to five times, of the pinnæ and pinnulæ two to three times longer than broad, shorter upwards; tetraspores terminal on the apices of the upper pinnulæ.

Callithamnion *gracillimum.*—*Ag. Sp. Alg.* vol. ii. p. 168; *Wyatt, Alg. Danm.* No. 45; *Endl.* 3rd Suppl. p. 34; *Kütz. Phyc. Gen.* p. 372; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 345; *Harv. P. B.* plate 5; *Harv. Man.* p. 180; *Harv. Syn.* p. 153; *Atlas*, plate 59, fig. 274; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 43.

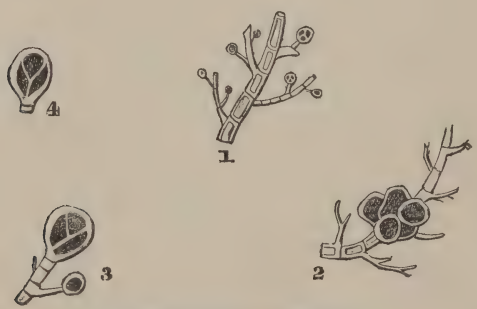
Hab.—On mud-covered perpendicular rocks, near low-water mark. Annual. Summer. Rare. On the pier at Torquay (*Mrs. Griffiths*); Milford Haven (*Mr. Ralfs*); Falmouth (*Miss Warren*); Beaumaris (*Mrs. Gulson* and others).

Geogr. Dist.—Atlantic coast of France; Grateloup; south and west of England.

Description.—Fronds much tufted, very slender and delicate, two to four inches long, capillaceous, much branched in a regularly distichous and alternately pinnate manner; primary pinnæ long, narrow, pinnules longest at the base, gradually shorter upwards, repeatedly pinnate, all the divisions erecto-patent, regularly alternate and distichous, every articulation generally producing its ramulus, all tapering to an obtuse point. Articulations of the stem and main branches three to four times as long as broad, gradually shorter upwards, nearly cylindrical, or slightly contracted above the middle and at the dissepiments. Substance very delicately membranous, and closely adhering to the paper. Colour, a fine deep rose red, readily discharged in fresh water, and giving out a "quantity of brilliant carmine powder, which permanently stains paper." Favellæ "roundish or irregularly lobed, springing from the larger branches." Tetraspores terminal on the tips of the ultimate ramuli or pinnulæ, very minute, not unfrequent, while the favellæ seem very rare, and seldom abundant even when present.

One of the most graceful and beautiful, even in a genus in which gracefulness and beauty constitute their characteristic feature. When the long, slender, delicate pinnæ are well grown and free from parasites, and either waving gracefully in its native element or carefully spread out on paper, a more beautiful species will scarcely be found in any genus. Confined to the southern shores of the kingdom, and there not hitherto found in anything like plenty, it is considered one of our rarer species, and should be carefully looked for about or a little beyond low water, on somewhat muddy rocks.

Dr. Harvey has pointed out its close affinity with *C. thuyoideum*, from which it is chiefly distinguished by its larger size, more regularly distichous, branching, somewhat more closely placed divisions, and somewhat shorter joints. Its beautiful fern-like fronds are said to have suggested to Mrs. Griffiths the name of "Fern-leaf Alga," a term at once euphonious and appropriate.




CALLITHAMNION GRACILLIMUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Portion of branch with tetraspores.
2.—Portion of branch with favellæ.
3, 4.—Tetraspores. All magnified.

# Plate CXXVII.

## CALLITHAMNION THUYOIDEUM.—*Harv.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from *καλὸς*, "beautiful," and *θάμνος*, "a shrub."

Callithamnion *thuyoideum*.—Fronds tufted, branched; branches distichous, bi-tripinnated, frequently with secondary plumules, which are long, linear, or linear-lanceolate; articulations of the stem and branches very variable, even in the same frond, three to six times as long as broad, shorter upwards; tetraspores terminal on the pinnulæ.

Callithamnion *thuyoideum*.—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 346; *Harv. P. B.* plate 269; *Harv. Man.* p. 181; *Harv. Syn.* p. 153; *Atlas*, plate 59, fig. 275.

Callithamnion *thuyoides*.—*Ag. Sp. Alg.* vol. ii. p. 172; *Endl.* 3rd Suppl. p. 34; *Kütz. Sp. Alg.* p. 645; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 44.

Callithamnion *tripinnatum*.—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 346 (not of *Agardh*); *Wyatt, Alg. Danm.* No. 186.

Conferva *thuyoides*.—*E. Bot.* t. 2205.

Hab.—On rocks near low water. Rare. Annual. Spring and summer. Yarmouth (*Mr. Borrer*); Plymouth (*Mr. Boswarva*, &c.); Pier, Torquay (*Mrs. Griffiths*); Falmouth (*Miss Warren*); Ilfracombe and Bracelet Bay, Swansea (*Mr. Ralfs*); Wicklow (*Dr. Harvey*); Portaferry (*Mr. W. Thompson*); Roundstone (*Mr. M'Calla*).

Geogr. Dist.—British Islands; Atlantic coasts of France.

Description.—Fronds single or scarcely tufted, slender and capillary, one to three inches long; branches distichous, closely and repeatedly pinnated with regularly alternate plumules, which are long, generally widest upwards, often furnished with secondary plumules, or occasionally even with a third set, all bi-tripinnated, the pinnæ and pinnulæ longest about the middle or towards the summit, shorter towards the base, giving the frond a lanceolate or linear-lanceolate outline; the ultimate pinnulæ short, cylindrical, somewhat obtuse; all erecto-patent, and somewhat closely placed. Articulations very variable; those of the stem and branches four to six times longer than broad, gradually shorter upwards, cylindrical, tapering very slightly upwards to an obtuse point. Substance very soft and flaccid, closely adhering to paper. Colour, a very delicate

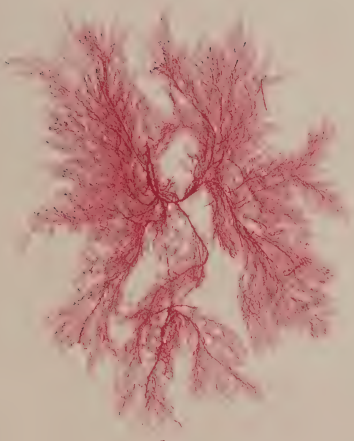
rosy pink, occasionally brownish, especially when old, very soon discharged in fresh water. Favellæ much less common than the tetraspores, lateral on the branches, two or more together. Tetraspores terminal on the ultimate pinnulæ, very minute and solitary.

Scarcely yielding in elegance to the last species, the present is almost equally limited in its distribution, and scarcely more abundant in the few localities where it has hitherto been found. It is also said to affect similar situations to the last, namely, the bases of perpendicular, generally somewhat muddy rocks, at or a little beyond low-water mark, or even occasionally a little above low water in deep, sheltered, rather muddy pools, which are not too much infested with other Algæ.

The larger specimens closely resemble *C. gracillimum*, but are seldom so much tufted; the main stem is generally percurrent, and the branching is always truly distichous. Like the last, its tetraspores are always decidedly terminal, in which they differ from all the other species with decomposite fronds. The favellæ we have seldom seen, but the tetraspores are by no means scarce, and generally abundant when produced.

## EXPLANATION OF PLATE CXXVII.

Fig. 1.—*Callithamnion thuyoideum*, natural size.
2.—Pinnule with tetraspores.
3.—Pinnule with favellæ.
4.—Tetraspore.
5.—Articulation. All magnified.



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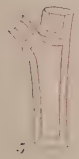

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*Callithamnion thuyoideum*, Ag.

Nature Printed by Henry Bradbury.

# Plate CXXVIII.

## CALLITHAMNION CORYMBOSUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants; 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *corymbosum.*—Fronds rather gelatinous, densely tufted, very much branched; branches mostly alternate, capillaceous, ultimate branches subdichotomously flabelliform, ultimate ramuli patent, their apices obtuse; articulations of the principal branches eight to ten times longer than broad; tetraspores lateral, opposite the axils of the upper dichotomies.

Callithamnion *corymbosum.*—*Ag. Sp. Alg.* vol. ii. p. 165; *Wyatt, Alg. Danm.* No. 92; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 346; *Harv.* in *Mack. Fl. Hib.* part 3, p. 216; *Harv. P. B.* plate 272; *Harv. Man.* p. 181; *Harv. Syn.* p. 154; *Atlas*, plate 59, fig. 276; *Harv. N. B. A.* part 2, p. 236; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 41.

Callithamnion *versicolor.*—*Ag. Sp. Alg.* vol. ii. p. 170; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 346; *Harv.* in *Mack. Fl. Hib.* part 2, p. 165; *Harv. Man.* 1st ed. p. 112.

Phlebothamnion *corymbosum.*—*Kütz. Phyc. Un.* p. 375; *Sp. Alg.* p. 657.

Phlebothamnion *versicolor.*—*Kütz. Phyc. Un.* p. 375; *Sp. Alg.* p. 657.

Ceramium *corymbosum.*—*Ag. Syn.* p. 27; *Ag. Syst.* p. 138.

Ceramium *versicolor.*—*Ag. Syst.* p. 140.

Conferva *corymbosa.*—*Eng. Bot.* t. 2352.

Hab.—On rocks, stones, old shells, various Algæ, and on the leaves of *Zostera*, near low-water mark. Annual. Summer. Common all round our coasts.

Geogr. Dist.—Atlantic and Mediterranean coasts of Europe; east coast of North America.

Description.—Fronds from a minute disc, densely tufted, two to three inches long, slender and capillary, densely branched; branches mostly subdichotomous, more regularly so upwards, sometimes the principal branches are less regularly alternate; all the divisions are very nearly cylindrical, each subdivision being scarcely half so thick as the one from which it springs, and each composed of a single joint, the apical ones about as broad as long, rather patent, and very obtuse, all

the lower axils acute, the divisions erecto-patent, and the articulations very long and cylindrical, in old plants those at the base frequently more or less filled with slender articulated filaments. Substance very tender and gelatinous, and closely adhering to the paper in drying. Colour, a fine rosy red or pink when fresh, soon changing in fresh water to an orange or pale brown. Favellæ "generally in pairs, terminating the secondary branches, and sometimes surrounded by a few forked ramuli." Tetraspores spherical, sessile, opposite or a little below the axils of the upper ramuli.

The present by no means uncommon species includes what has by many been considered two species, *C. corymbosum* and *C. versicolor*, two species which seem much too nearly allied for separation, when both species are acknowledged to be of such variable character, and especially when the differences are only of secondary importance.

The species seems pretty generally distributed, and is frequent in sheltered bays, estuaries, and places where the water is slightly brackish, on the leaves of *Zostera marina*, and other marine plants, as well as on rocks and stones, especially in a rather muddy bottom.

Its newest ally is said to be *C. spongiosum*, but that may be at once distinguished by its shorter articulations, much more densely bush habit, much stouter stems, more tapering to the apices, which are less obtuse and rather more slender. It does not seem abundant on the east coast, but we have gathered it but sparingly in widely distant localities; both kinds of fruit seem to be not uncommon.

EXPLANATION OF PLATE CXXVIII.

Fig. 1.—*Callithamnion corymbosum*, natural size.
2.—Ramulus with tetraspores.
3.—Ramulus with favellæ.
4.—Articulation. All magnified.

1

2

4

3

*Callithamnion corymbosum, flg.*

Nature drawn by Henry Bradbury.

# Plate CXXIX.

## CALLITHAMNION GRANULATUM.—*J. G. Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *granulatum*.—Fronds much tufted, stout and cartilaginous, opaque, with veins below, pellucid above, much branched and gradually tapering to a somewhat acute point; primary branches often again divided, all the branches thickly set with short capillaceo-multifid ramuli; articulations short, contracted in the middle, and at the dissepiments.

Callithamnion *granulatum*.—*J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 61.

Callithamnion *spongiosum*.—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 346; *Harv.* in *Mack. Fl. Hib.* part 3, p. 217; *Wyatt, Alg. Danm.* No. 93; *Crouan,* in *Desm. Pl.; Harv. P. B.* plate 125; *Harv. Man.* p. 182; *Harv. Syn.* p. 155; *Atlas,* plate 57, fig. 265.

Hab.—On rocks, stones, old shells, and parasitical on other Algæ, near low-water mark. Annual. Summer. Not very uncommon from Cornwall to Orkney.

Geogr. Dist.—British Islands; Atlantic shores of France.

Description.—Fronds densely tufted, two to four inches high, rather robust at the base, gradually tapering upwards, much and sometimes repeatedly branched; the branches long, mostly quadrifarious, and everywhere set with short densely and repeatedly dichotomous ramuli, gradually tapering upwards, the terminal joints cylindrical, with a somewhat acute apex; all the divisions erecto-patent, the axils rather acute. Articulations of the main divisions two or three times longer than broad, more or less opaque, with veins below, which arise from the bases of all the branches and proceed downwards; upper articulations pellucid and gradually but very slightly decreasing in length, so that the apical joints are about the same *proportionate* length as the lower, slightly contracted in the middle and at the dissepiments, every joint furnishing its ramulus at its upper angle. Substance, in the mass soft and spongy; but the individual branches are rather firm and cartilaginous, closely adhering to paper. Colour, a dark brownish purple,

very dark in the mass. Favellæ terminal on shortened branches, "frequently surrounded by dichotomous ramuli," mostly bilobed, rather large. Tetraspores elliptical, sessile, opposite the axils of the upper ramuli, generally abundant.

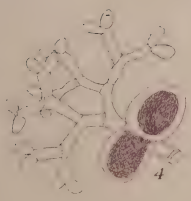
This species is remarkable among its congeners by the denseness of its branching, in the mass more resembling a bit of sponge than any thing else. In this respect it more nearly resembles *C. arbuscula* than any other species of the genus, but is even more densely ramified than that species, and retains the water in the manner of a sponge.

From *C. arbuscula* it is not always easily distinguished at first sight, but in the microscope it may be readily known by its differently formed articulations, every one of which emits its ramulus; each ramulus thus consists of a single articulation, whereas in *C. arbuscula* the ultimate ramuli are multiarticulate. In the present species the tetraspores are solitary, and in *C. arbuscula* they are arranged in continuous rows along the upper edge of the ultimate ramuli.

On the east coast, *C. arbuscula* is one of our most common species, while *C. granulatum* is only occasionally observed; the former mostly on mussel-shells, the latter more frequently parasitical on other Algæ, and not usually in fruit.

EXPLANATION OF PLATE CXXIX.

Fig. 1.—*Callithamnion granulatum*, natural size.
2.—Ramulus with tetraspores.
3.—Tetraspore.
4.—Ramulus with favellæ.
5.—Joint of the stem. All magnified.



*Callithamnion granulatum, J.G. Ag.*

Nature Printed by Henry Bradbury.

## CALLITHAMNION ROTHII.—*Lyngb.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *Rothii*.—Fronds very minute, densely tufted, forming minute tufts or somewhat spreading strata, erect, sparingly branched; branches irregularly dichotomous, very erect and subcorymbose at the summit; articulations about twice as long as broad; tetraspores clustered on short subterminal ramuli.

Callithamnion *Rothii*.—*Lyngb. Hyd. Dan.* p. 129, t. 41; *Ag. Syst. Alg.* vol. ii. p. 185; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 347; *Wyatt, Alg. Danm.* No. 188; *Endl.* 3rd Suppl. p. 34; *Kütz. Phyc. Gen.* p. 471; *Harv. P. B.* plate 120 B.; *Harv. Man.* p. 183; *Harv. Syn.* p. 156; *Atlas*, plate 60, fig. 278; *Harv. N. B. A.* part 2, p. 242; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 17.

Ceramium *Rothii*.—*Berk. Gl. Br. Alg.* t. 20.

Trentepohlia *Rothii*.—*Harv.* in *Mack. Fl. Hib.* part 3, p. 218.

Conferva *Rothii*.—*Linn. Syst. Nat.* vol. vi. p. 1806; *Dillw. Conf.* t. 73; *E. Bot.* t. 1702; *Jurg. Alg. Dec.* No. 10.

Conferva *violacea*.—*Roth, Cat. Bot.* vol. i. p. 190, t. 4, f. 1; *Fl. Germ.* vol. iii. part 1, p. 525.

Var. β. *purpurea*.—Filaments very minute, slightly branched, forming small velvet-like patches.

Callithamnion *purpureum*.—*Harv. Man.* 1st ed. p. 116.

Trentepohlia *purpurea*.—*Ag. Syst.* p. 36; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 382; *Harv.* in *Mack. Fl. Hib.* part 3, p. 218.

Byssus *purpureum*.—*E. Bot.* t. 192.

Conferva *purpurea*.—*Dillw.* t. 43.

Callithamnion *Rothii*, β *purpureum*.—*Harv. P. B.* descrip. plate 120 B.; *Harv. Man.* p. 183; *Harv. Syn.* p. 156; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 18; *Harv. N. B. A.* part 2, p. 242.

Hab.—On the surface of rocks from about half-tide level. β, on rocks within the reach of the spray, but not of ordinary tides. Perennial. Winter. Common.

Geogr. Dist.—Atlantic shores of Europe; Baltic Sea; east coast of North America.

Description.—Fronds minute, forming minute densely pulvinate tufts, or by afterwards becoming confluent, more or less widely-spreading

strata; filaments slender, cylindrical, sparingly branched upwards; branches cylindrical, very erect, with acute axils and obtuse rounded apices. Articulations short, about once and a-half or twice as long as broad, and of nearly equal diameter throughout. Substance tender, rather flaccid, and adhering to the paper in drying. Colour, a fine deep pinky or purplish red. Favellæ unknown. Tetraspores common, produced on short subterminal ramuli, in little subcorymbose clusters.

This minute species is very common on most of our shores, extending its local range even to the utmost limit of high water, and generally forms minute tufts or rather spots on the surface of the rock, more conspicuous from their brighter colour than by their size. These often become confluent, and eventually form more or less extensive strata; but the filaments are generally too short to permit of their being removed from the rock, except in the form of a fibrous looking powder. The more dwarfish specimens near high-water mark are those most frequently fruited.

Its favourite habitat is the shady side of rocks and stones, under arches, &c., where it can be sheltered from the noon-day sun, and in such localities the eye of the careful collector will seldom fail in finding our little favourite in greater or less abundance, and when well fruited, a more interesting microscopic object can scarcely be selected.

We follow Dr. Harvey in uniting the old "*Byssus purpurea*" to this species as a variety, being firmly persuaded after careful examination this is its proper place.

CALLITHAMNION ROTHII.

EXPLANATION OF DISSECTIONS, &c.

Fig. 1.—*Callithamnion Rothii*, natural size.
2.—Filaments.
3.—Tufts of tetraspores.
4.—A tetraspore. All magnified.

## CALLITHAMNION FLORIDULUM.—*Ag.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *floridulum*.—Fronds forming densely pulvinate subglobose tufts, erect, sparingly divided in a subalternate or dichotomous manner; all the divisions long, erect, without lateral ramuli; articulations cylindrical, about three times as long as broad; tetraspores elliptical, lateral on short pedicels.

Callithamnion *floridulum*.—*Ag. Sp. Alg.* vol. ii. p. 188; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 348; *Wyatt, Alg. Danm.* No. 219; *Kütz. Phyc. Gen.* p. 371; *Harv. P. B.* plate 120 A.; *Harv. Man.* p. 183; *Harv. Syn.* p. 156; *Atlas*, plate 59, fig. 277; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 19.

Trentepohlia *floridula*.—*Harv.* in *Mack. Fl. Hib.* part 3, p. 218.

Conferva *floridula*.—*Dillw. Conf.* Suppl. t. F.

Hab.—On sand-covered rocks, near low-water mark. Perennial? Galway coast, abundant; Clare, Kerry, and east coasts of Ireland; Antrim (*Dr. Scott*); Orkney (*Rev. H. Pollexfen*); Peterhead (*Mr. T. Bell*); Lands' End (*Mr. Ralfs*).

Geogr. Dist.—Coast of France.

Description.—Fronds densely tufted, forming more or less globose masses of from half an inch to an inch in diameter, sparingly and distantly branched; branches subdichotomous, alternate or secund, long and cylindrical, without lateral ramuli, and more or less corymbose at the summit. Articulations nearly equal throughout, about two and a-half or three times as long as broad, cylindrical, the branches all very erect, with rounded obtuse apices and very acute axils. Favellæ appear to be unknown. Tetraspores are not unfrequent, unilateral on short pedicels on the upper branches. Substance membranous, rather firm, and rather imperfectly adhering to paper. Colour, a rather dull pinky red, "the bases often fading to a dull green."

This very pretty little species seems very local in its geographical range in this country, being mostly confined to the west of Ireland, where it is said to be abundant at least in one or two places, but only occasionally met with on other parts of our shores.

It forms roundish or hemispherical cushion-like tufts on sand-covered rocks, near low-water mark.

This and the following species form a very curious little group, remarkable for their small size, and in most of the species for the simplicity of the ramification. No *favellæ*, so far as we are aware, have been observed on any of them.

CALLITHAMNION FLORIDULUM.

EXPLANATION OF DISSECTIONS, &c.

Fig. 1.—*Callithamnion floridulum*, natural size.
2.—Filament with tetraspores.
3.—Tetraspores from same.
4.—A tetraspore. All magnified.

## CALLITHAMNION MESOCARPUM.—*Carm.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *mesocarpum*.—"Stems rising from creeping filaments, erect, simple or sparingly branched; branches alternate, very erect, naked or having a few, scattered, erect ramuli; articulations four or five times as long as broad; tetraspores elliptical, on long, simple, or forked lateral pedicels."

Callithamnion *mesocarpum*.—*Carm. Alg. Appin, MSS.; Harv.* in *Hook. Br. Fl.* vol. ii. p. 348; *Harv. P. B.* plate 325; *Harv. Man.* p. 184; *Harv. Syn.* p. 157; *Atlas*, plate 60, fig. 279; *Kütz. Sp. Alg.* p. 642; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 16.

Hab.—On rocks at the extremity of low-water mark. Very rare. Appin (*Captain Carmichael*).

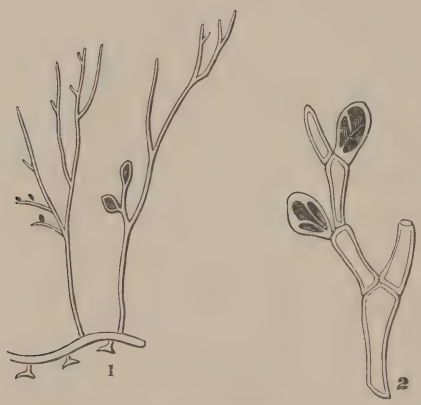
Geogr. Dist. —— ?

Description.—"Tufts continuous, forming a broad, shaggy, purple crust" (*Carm.*). Stems from an eighth to a quarter of an inch or rather more in height, springing from decumbent filaments, which are attached to the surface of the rock by little rootlets, erect, simple or having two or three alternate or secund branches; branches issuing at very acute angles, erect, virgate, either quite naked or furnished with a few distant, erect, scattered, few-jointed ramuli. Articulations four or five times as long as broad, with wide borders; tetraspores elliptical, borne on the tips of the lateral ramuli, which are generally one-jointed, and either simple or forked, in which case one arm of the fork is converted into a tetraspore. Favellæ unknown. Colour, a full deep lake. Substance membranaceous, adhering to paper in drying."—*Phyc. Brit.* pl. 325.

The only authority for the present species, so far as we are aware, depends on some solitary fragments preserved in the herbarium of Sir W. Jackson Hooker, and collected at Appin by the late Captain Carmichael, and the only knowledge of the species is derived from the figures and descriptions in *Phycologia Britannica*, where it is carefully described from Captain Carmichael's original specimens.

Professor Harvey has pointed out its close affinity with *C. Turneri*, from which it differs in its rather shorter joints, more simple and erect filaments, more obtuse at the apices ; the position of the tetraspores is also different. In short, while some other very closely allied species are allowed to retain their position, we hardly see how these two can be united.

Our present knowledge, however, of both species is very limited, and we would earnestly invite the attention of observers to these minute and obscure forms, in the hope that additional facts in their history may be brought to light, and our knowledge of the species rendered more accurate.




CALLITHAMNION MESOCARPUM.

EXPLANATION OF DISSECTIONS.

Fig. 1.—Filaments with tetraspores.
2.—Tetraspores from same. Both magnified.
*Phyc. Brit.*

## CALLITHAMNION SPARSUM.—*Harv.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *sparsum.* — "Parasitical, minute; filaments tufted and scattered, sparingly branched; branches spreading, unequal; articulations twice or thrice as long as broad; tetraspores 'obovate, sessile, mostly axillary' (*Carmichael*)."—*Phyc. Brit.*

Callithamnion *sparsum.*—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 348; *Harv. P. B.* plate 297; *Harv. Man.* p. 184; *Harv. Syn.* p. 157; *Atlas*, plate 60, fig. 280; *Kütz. Sp. Alg.* p. 643; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 15.

Callithamnion *floridulum.*—*Lyngb. Hyd. Dan.* p. 130, t. 41 (not of *Phyc. Brit.*).

Trentepohlia *sparsa.*—*Harv.* in *Mack. Fl. Hib.* part 3, p. 219.

Hab.—On old stems of *Laminaria saccharina* at Appin (*Capt. Carmichael*); on *Cladophora rupestris* at Miltown Malbay (*Dr. Harvey*).

Geogr. Dist.—Shores of Greenland (*Gieseke*).

Description.—"Fronds forming small scattered tufts, one or two lines in height, and as much in diameter, composed of erect, closely set filaments. Filaments nearly simple or furnished with two or three simple, alternate, or secund branches, equalling the main filament in diameter, cylindrical and obtuse. Articulations about once and a-half as long as broad, with pellucid dissepiments. Tetraspores (which I have not seen) 'obovate, sessile, mostly axillary' (*Carm.*). Substance membranaceous. Colour, a clear crimson red."—*Phyc. Brit.*

Equally obscure and little known with the last species, the present is said to be very nearly allied to *C. Daviesii*, and in other respects to *C. Rothii*, but "to differ from both in the very simple filaments and flexuous branches." The articulations appear also to be somewhat longer than those of *C. Rothii*, but we have often met with specimens of *C. Rothii* (?) which certainly come very close to the present species. We have, therefore, given the figures partly as in *Phyc. Brit.* in the hope that more accurate information may be obtained for future description.

It may be proper to add that Dr. Harvey has not been able to find on the portion of Captain Carmichael's specimen examined the axillary tetraspores, which that observer describes, and from which the drawings, &c., in *Phyc. Brit.* are taken.

CALLITHAMNION SPARSUM.

EXPLANATION OF DISSECTIONS, &c.

Fig. 1.—*Callithamnion sparsum*, natural size, on *Laminaria digitata*.
2.—Filaments.
3.—Articulations. Both magnified.
*Phyc. Brit.*

## CALLITHAMNION DAVIESII.—*Lyngb.*

Gen. Char.—Fronds filiform and articulated, sometimes at length in the older parts cellular and partially opaque, single-tubed; divisions mostly pinnate, dissepiments hyaline. Fructification of two kinds, on distinct plants: 1. Favellæ, mostly lateral on the branches, and filled with minute spores; 2. Tetraspores, external, tripartite or cruciate. Name from καλὸς, "beautiful," and θάμνος, "a shrub."

Callithamnion *Daviesii.*—Fronds very minute, closely tufted, or forming a continuous stratum on the surface of other Algæ; filaments much branched; branches scattered, slightly curved, distant, having a few secund or alternate, subulate, scattered ramuli, furnished with three to four short, secund ramellæ collected on the upper edge and towards the base of the ramuli; tetraspores pedicellate, lateral on the axillary ramuli.

Callithamnion *Daviesii.*—*Lyngb. Hyd. Dan.* p. 129, t. 41; *Ag. Sp. Alg.* vol. ii. p. 186; *Harv.* in *Hook. Br. Fl.* vol. ii. p. 348; *Harv. P. B.* plate 314; *Harv. Man.* p. 184; *Harv. Syn.* p. 157; *Atlas*, plate 60, fig. 281; *Harv. N. B. A.* part 2, p. 243; *Kütz. Sp. Alg.* p. 638; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 11.

Trentepohlia *Daviesii.*—*Harv.* in *Mack. Fl. Hib.* part 3, p. 219.

Conferva *Daviesii.*—*Dillw. Conf.* t. F; *E. Bot.* t. 2329.

Hab.—Parasitical on the smaller Algæ, in pools and on rocks between tide-marks. Annual. Summer; autumn. Common.

Geogr. Dist.—Atlantic shores of Europe; North America.

Var. β. *virgatulum.*—Ramuli mostly from every joint, single-jointed, very minute, secund or alternate.

Callithamnion *virgatulum.*—*Harv.* in *Hook. Br. Fl.* vol. ii. p. 349; *Wyatt, Alg. Danm.* No. 189; *Harv. P. B.* plate 313; *Harv. Man.* p. 184; *Harv. Syn.* p. 158; *Atlas*, plate 60, fig. 282; *J. G. Agardh, Sp. Gen. Alg.* vol. ii. p. 12.

Callithamnion *Daviesii*, var.—*Harv. Man.* 1st edit. p. 117.

Hab.—Parasitical on the smaller Algæ, and likely to be found where *C. Daviesii* is met with.

Geogr. Dist. ——? Likely to be the same as *C. Daviesii.*

Description.—Fronds very minute, from one to four lines in length, forming densely pulvinate tufts or more or less widely spreading strata on the surface of other Algæ, hardly apparent except from the brighter colours of the mass; filaments capillary, cylindrical, much branched;

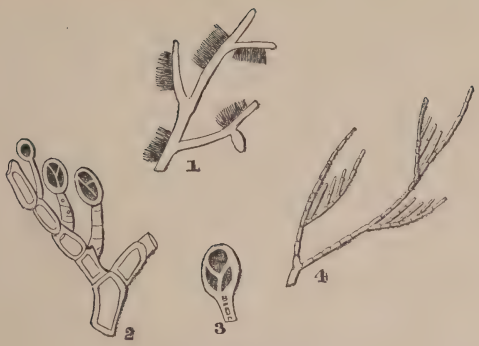
branches distant, irregularly alternate or secund, long and subulate, tapering to a rather obtuse point, furnished with a second series of similar shorter branches, which are simple above, furnished near the base on the upper edge with three to four short, simple, subulate ramuli ; that next the base longest, upper very short ; all more or less curved upwards. Substance delicately membranous, closely adhering to paper in drying. Colour, a pale but bright rose red. Favellæ unknown. Tetraspores minute, elliptical, pedicellate, lateral near the base of the axillary ramuli, solitary or two or three together.

This beautiful little species is scarcely less puzzling than its pigmy congeners, from the extreme variableness in its habit.

We have united the two forms, kept separate by most botanists under the names *C. Daviesii* and *virgatulum*, sensible of the impossibility of drawing any distinct line of demarcation between them. In reference to this, Dr. Harvey remarks in his own case, that he has figured "*virgatulum*" as a species more on account of "pressure from without" than from being satisfied in his own mind of their distinctiveness. It is only after very careful examinations and re-examinations we have united the two, and we trust future observation will prove the correctness of our judgment.

This species in one form or other appears very generally distributed on all our shores, and in many places in great abundance. On the eastern coast it is extremely abundant, covering everything that comes in its way for several yards with its short pilose fronds. So minute are these, that when under water they are scarcely apparent to the naked eye, still less so when out of water, until dry, when the plants that are infested with them appear as if washed over with a coat of paint. *Rhodymenia palmata, Alaria esculenta, Porphyra vulgaris, Chondrus crispus*, and many other common species, are often completely covered with it, especially when their fronds begin to decay. Its favourite habitat seems to be the seaward sides of exposed rocks near low water, where it is exposed to the full sweep of the surge, and where most of the Algæ, at an early part of the season, have become torn and disfigured by the force of the waves ; it thus clothes with an interesting and beautiful fringe objects which would not only be uninviting but positively repulsive to the eye.

This tiny plant is named after the late Rev. Hugh Davies, an accomplished botanist of the last generation, and whose name is of very frequent occurrence in English Botany. He discovered it about fifty years ago on the Welsh coast, since which time it has been traced all round our shores—on those of Europe generally as well as America.




CALLITHAMNION DAVIESII.

EXPLANATION OF DISSECTIONS, &c.

Fig. 1.—*Callithamnion Daviesii*, natural size.
2.—Tetraspores.
3.—A tetraspore.
4.—Part of a filament. All magnified.

END OF VOL. II.

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